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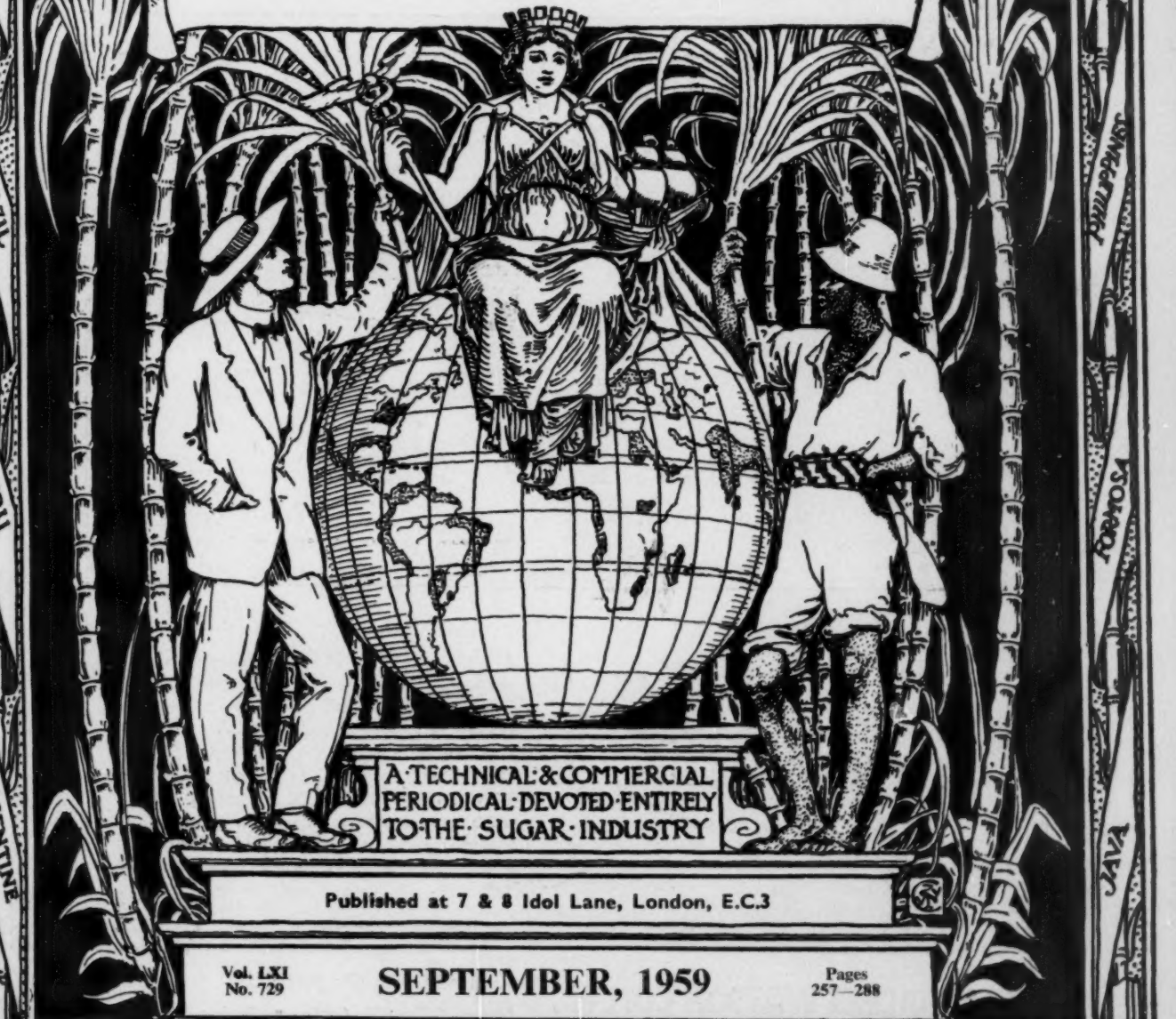

A·TECHNICAL·&·COMMERCIAL PERIODICAL·DEVOTED·ENTIRELY TO·THE·SUGAR·INDUSTRY

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No. 729

SEPTEMBER, 1959

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257—288

For LIST OF ADVERTISERS see page xliv

6,867

TONS/CANE/DAY

Illustration shows an 18 Roll Turbine-Driven Tandem Supplied to the Río Haina Sugar Company in the Dominican Republic for a nominal capacity of 5,000 TONS/CANE/DAY.

The Tandem is now grinding at the rate of 6,867 TONS CANE/DAY, and the photograph, which was taken with the mills in operation, illustrates clearly the reduced number of operators required to run a modern Milling Tandem.

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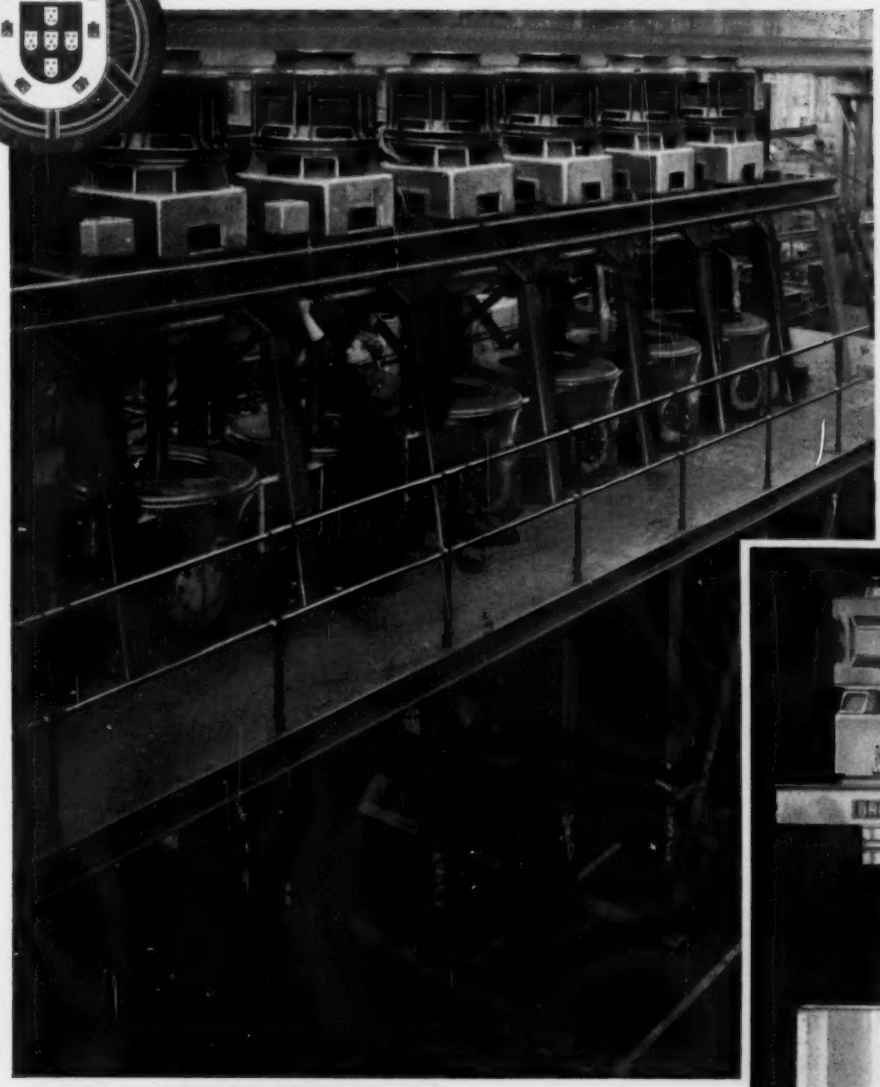

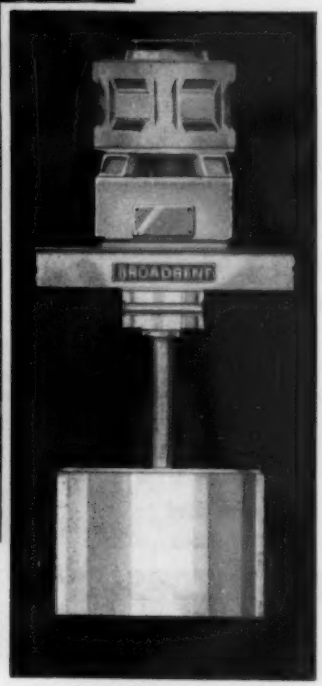

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FOR MOZAMBIQUE

A battery of six 42″ x 24″ centrifugals with 600/1200/1800 R.P.M. synchronous motors photographed during assembly and testing in our works prior to despatch to the LUABO factory of Sena Estates Ltd.

The machines are to be installed to cure C massecuites.

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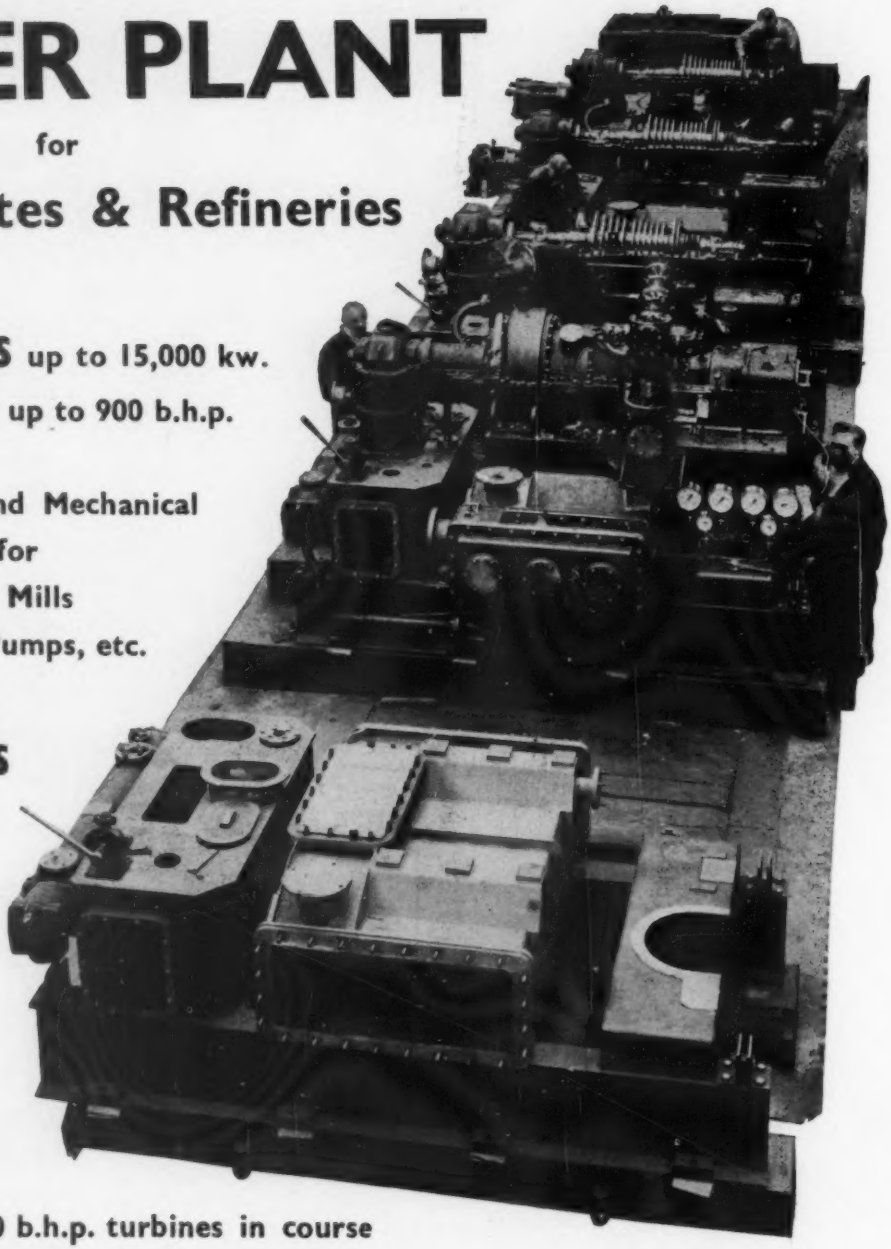

340 b.h.p. turbines in course
of construction in our works

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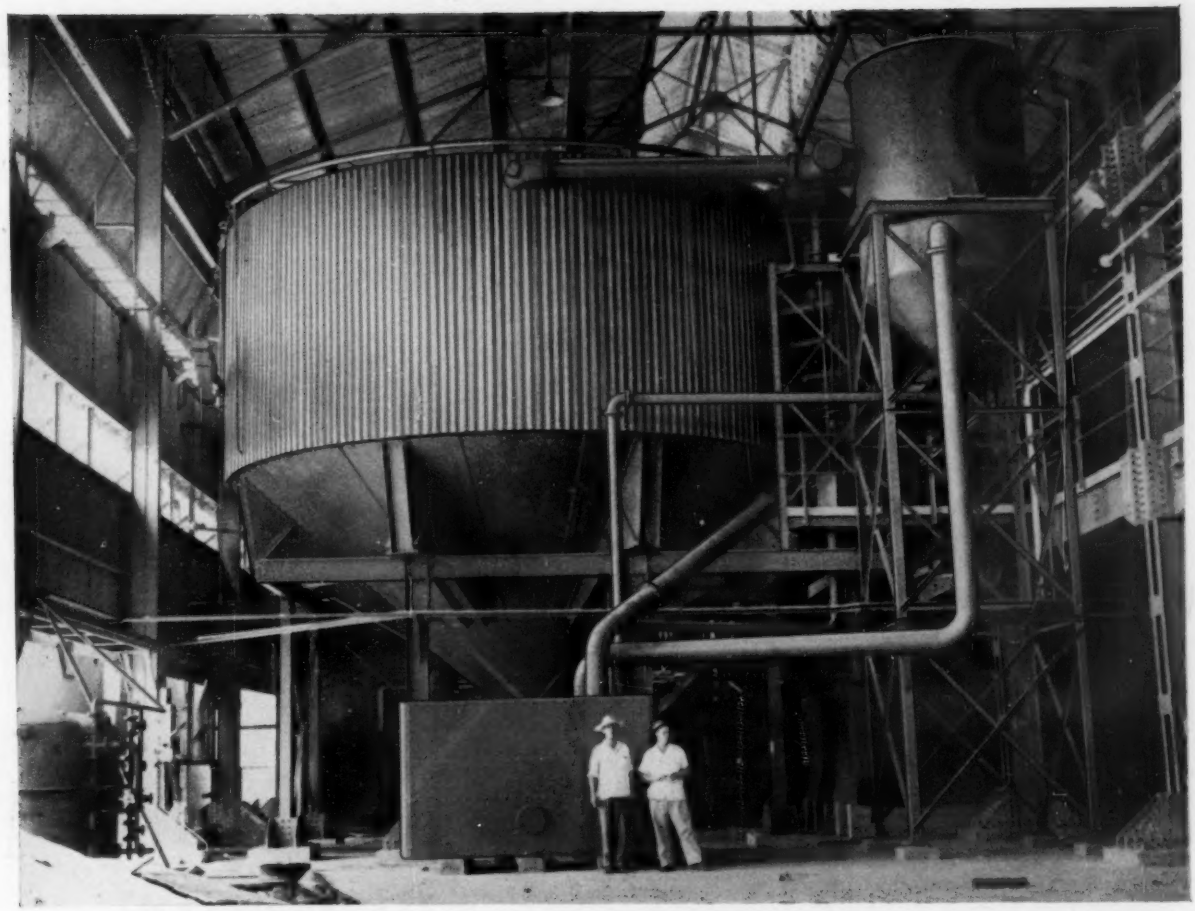

'Mirrlees'

BACH CONTINUOUS SUBSIDERS

Illustrated is one of our most recent installations, a 30 feet, 5 tray Subsider in operation in Venezuela.

This Subsider enables juice to be drawn off at 5 points of optimum clarity. Surface evaporation is obviated, no surface scum enters the tank, and a high temperature is maintained throughout the apparatus.

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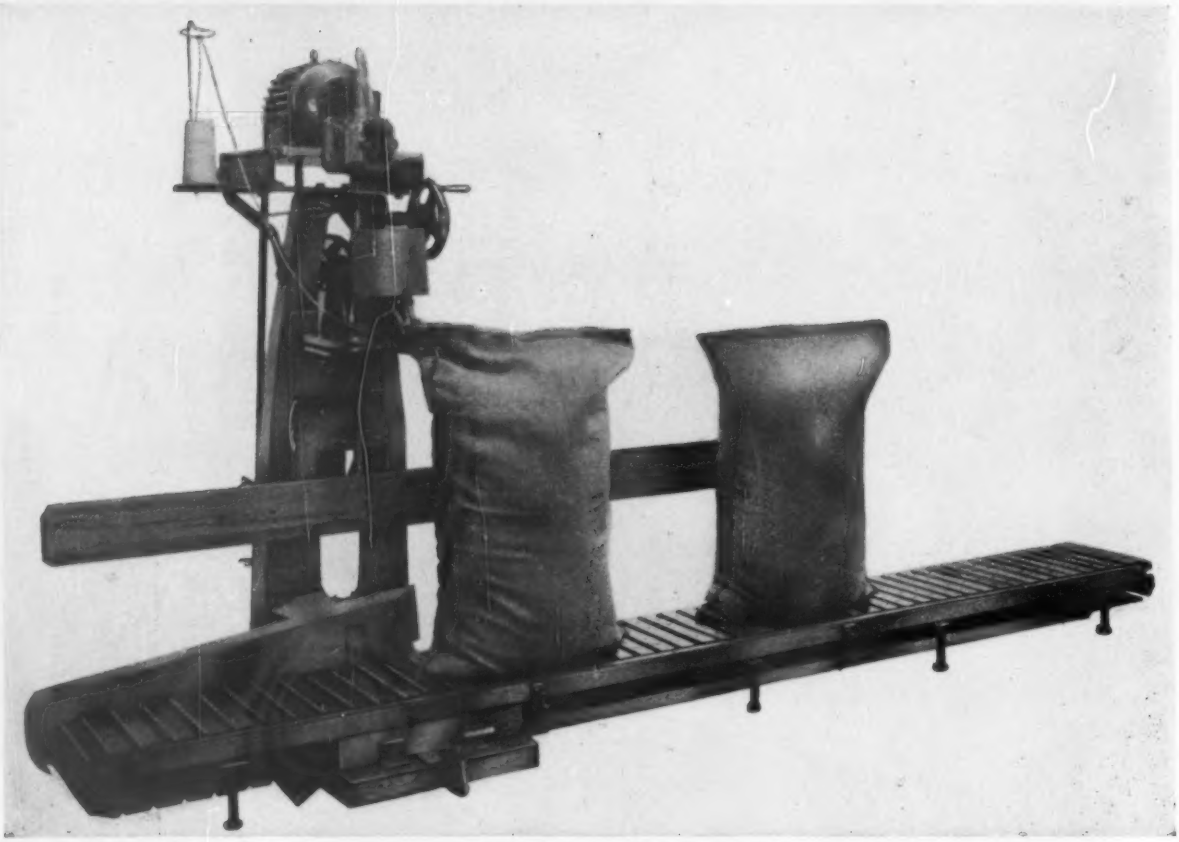
The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 h.p. *Shipping weight : 14 cwts.*

Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

(Timewell's Patent)

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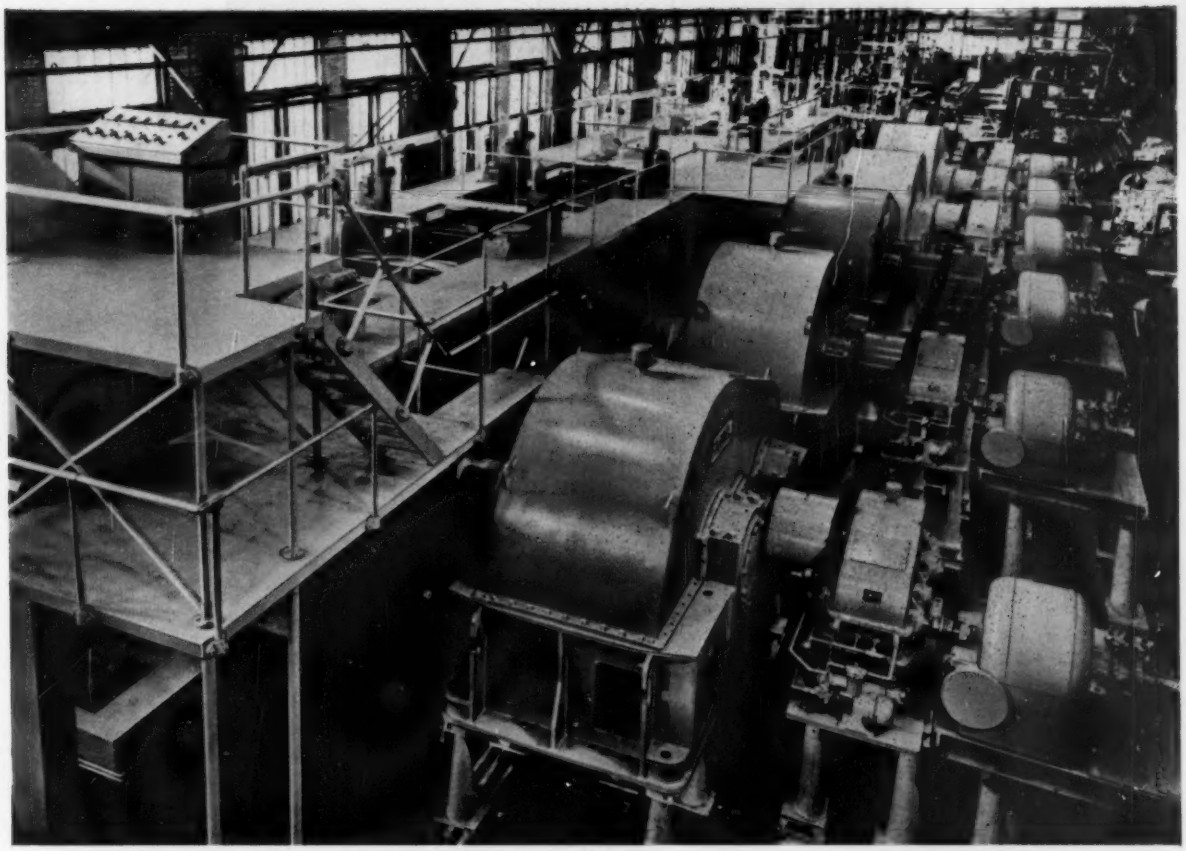
Telephone : HOWARD 1188 *Telegrams :* FECIT, ENFIELD



The most efficient cane-grinding equipment you can buy

In recent years, Farrel has pioneered in the development of a number of design improvements in cane-sugar grinding equipment. These have resulted in increased sucrose extraction, lower operating costs, simplified maintenance, and improved reliability.

Outstanding design innovations include (1) hydraulic-ram mechanisms which maintain uniform roll pressure with full freedom for self alignment, (2) force-feeding rollers for better mill feed, (3) side and top-cap constructions that permit fast, vertical removal of all rolls, and (4) the introduction of air clutches for better control of intermediate carriers and drives.

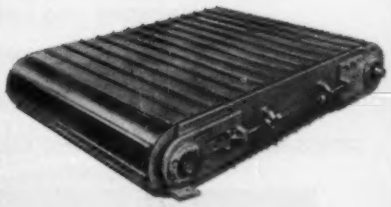
For the drive section, fabricated gears of greater strength have been developed to withstand the increased loads imposed by turbine drive. Separate gear units, one for the first two reductions, and a second for the intermediate and final gear sets, eliminate the need for a common foundation and assure better alignment.

But, these are only a few of the many improvements made. Send for bulletin 312 which tells the story in greater detail.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT, U.S.A.
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

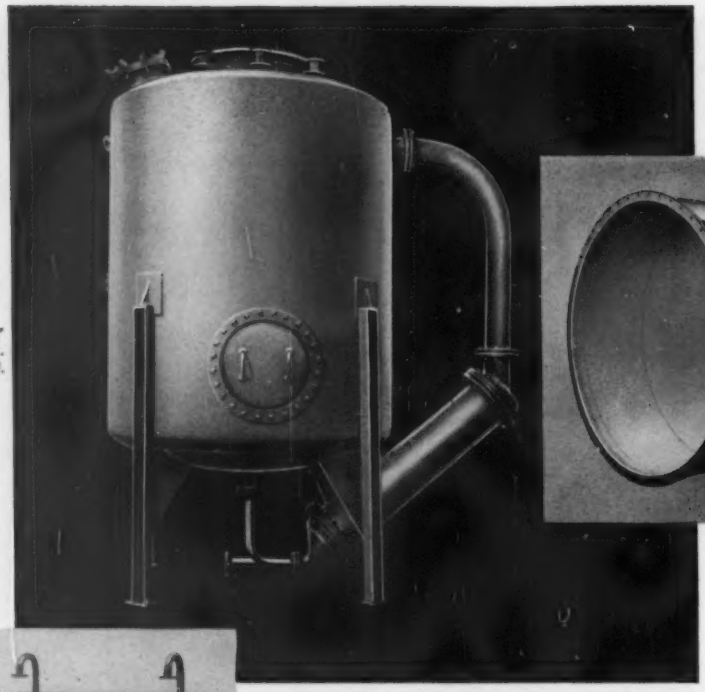
FB-1175

FARREL



RUBBER-BELT CARRIERS

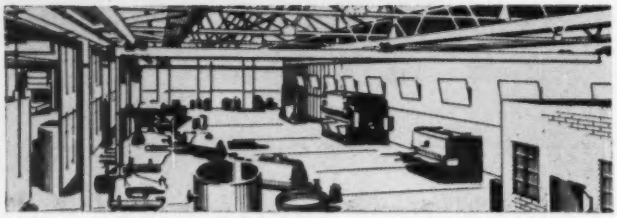
This patented device is a particularly significant development. It provides better retention of bagasse and imbibition, has greater force-feeding action than the slat type, and increases production significantly. First ones installed have handled approximately two and one-half million tons of cane with no down time and no replacement of parts.



1,000 gall. kettle in ¼" copper. Lynx Quasi-arc welded.

Stainless steel vessel with mild steel jacket

12,000 gallon water separator



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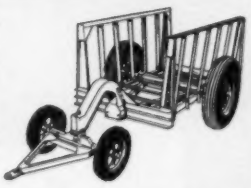
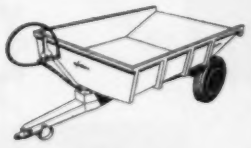
★ *They're not expensive*

★ *They're built for the job, and when it comes to rugged strength* **you can't beat the Markham specification!**

Markham's 5-Ton Heavy Pattern Sugar Cane Cart operates over the roughest terrain carrying large loads and is ideal for long journeys between plantation and factory. Large diam. rear wheels enable this cart to traverse uneven ground with ease. The swivel and pivot mounting of front axle ensure great stability making this Cane Cart extremely manoeuvrable.



For constructional jobs, road making, etc., this 3-ton hydraulic tipping 'Dumper' trailer is a winner; very strongly made, it will give years of service under the most arduous conditions.



For speedy, economical handling of cane, Markham's Cane Trailers are unsurpassed. They will work easily over rugged terrain, and their exceptional strength of construction ensures a long, trouble-free life.

A PRODUCT OF MARTIN-MARKHAM GROUP

Martin-Markham

MARKHAM TRACTION LTD.
LINCOLNSHIRE IRONWORKS
STAMFORD, LINCS.

Please send me details of your range of Cane Trailers and Landed costs.

NAME .....

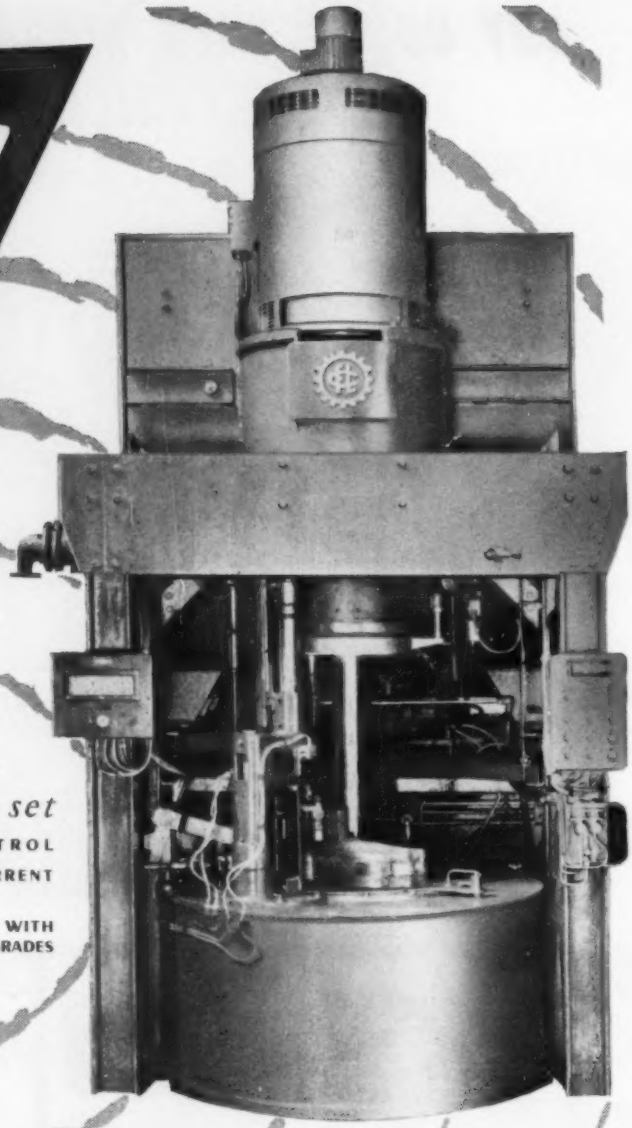
ADDRESS .....

Active selling organisations are still required in some of the Sugar Growing areas of the world, and Bona Fide trade enquiries will be welcomed.

Fully automatic!

the new

CENTRIFUGAL



driven by
WARD-LEONARD *set*

- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
- RECORD PRODUCTION WITH MASSECUITES OF ALL GRADES

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)

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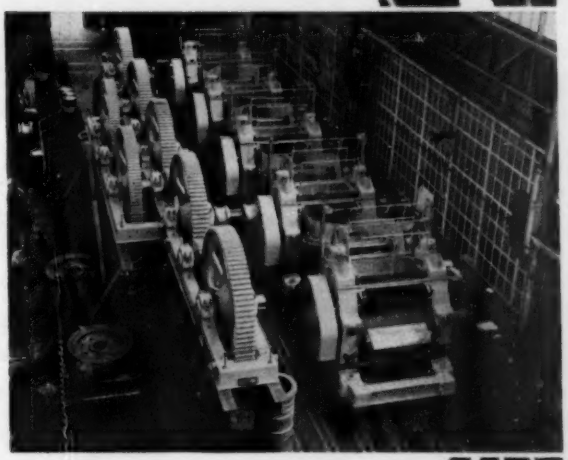
Your
complete
factory
from
cane
to
sugar



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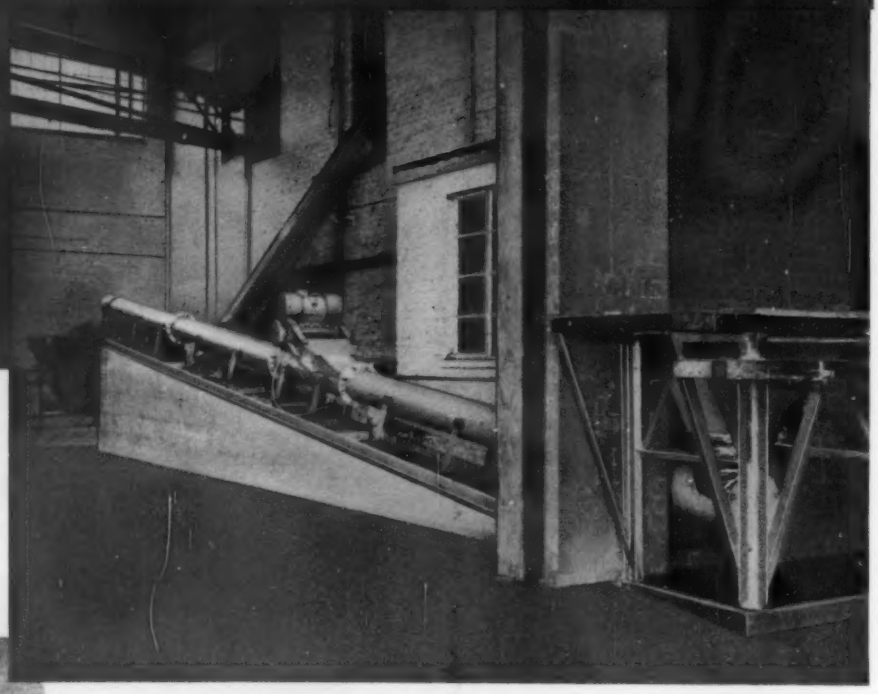
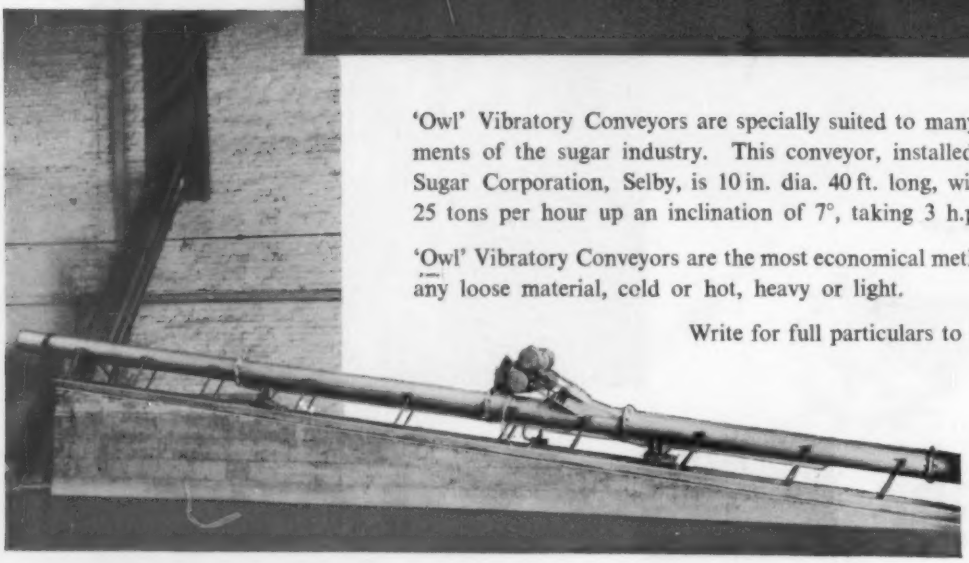
FOR ALL CANE SUGAR MACHINERY APPLY TO GEBR. STORK & CO N.V. - HENGELO - NETHERLANDS

'OWL' VIBRATORY CONVEYORS

for the Sugar Industry





'Owl' Vibratory Conveyors are specially suited to many of the requirements of the sugar industry. This conveyor, installed at The British Sugar Corporation, Selby, is 10 in. dia. 40 ft. long, with a capacity of 25 tons per hour up an inclination of 7°, taking 3 h.p.

'Owl' Vibratory Conveyors are the most economical method of conveying any loose material, cold or hot, heavy or light.

Write for full particulars to :—

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A member of the JOHN THOMPSON GROUP

OWL ENGINEERING SUPPLIES LTD

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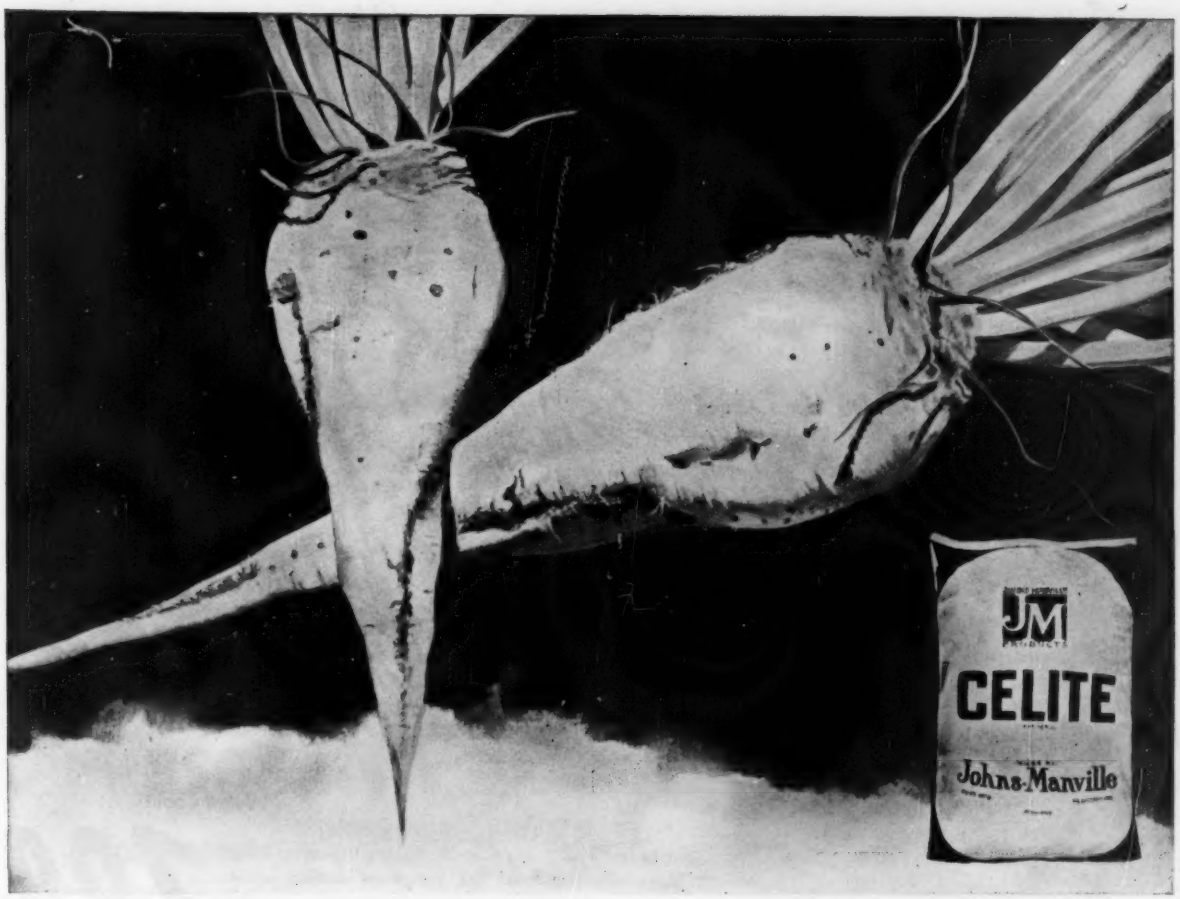


How to get high clarity and fast flow rates by filtering beet sugar liquors *with Celite*

When you're filtering beet sugar liquors, Celite* gives you the clarity you want at the flow rate you need. Yes, Celite Filtration gives you crystal-clear liquor, free of sediment, haze and suspended solids; fastest flow rates for economical operation; and bacteria removal as small as 0.1 micron. And with Celite's wide range of grades you can achieve these benefits in the exact balance you require.

There is more working filter aid per pound than any other diatomite. Because of its lower wet density, six bags of Celite will do the work of seven bags of other diatomites. *You save almost* 15% *when you let Celite do your filtering.*

For further information about Celite, simply write Johns-Manville International Corp., Box 60, New York 16, N.Y., U.S.A. **For England and Continental Europe:** Johns-Manville Co. Ltd., 20 Albert Embankment, London, S.E.11.

* *"Celite" is a Johns-Manville trade mark registered in many countries of the world*

Other famous J-M products widely used in the sugar industry include: Packings and Gaskets, Insulations and Friction Materials

Johns-Manville CELITE FILTER AIDS

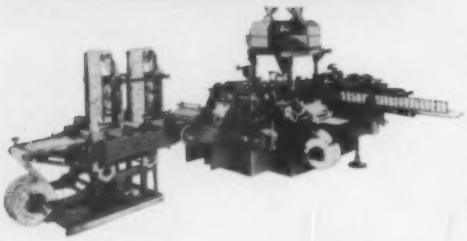
Sugar, being a basic consumer commodity, does not permit high packaging costs.

Therefore, cut packaging costs, to the minimum - pack automatically

HESSER

will show you the way.

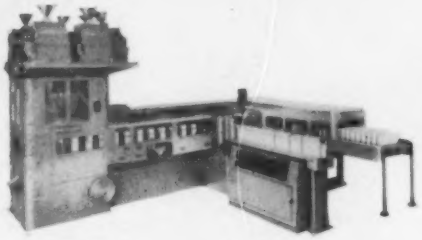
Output per 8 hour shift 2 persons in attendance, producing 2-lbs bags:



Machine Type PDHB(R)

equipped with 3 precision weighers makes up a lined bag, and fills and closes in one continuous operation. Up to three colour Aniline Printing attachment for printing the outer paper can be incorporated. This is the most economical way of manufacturing packages.

about **30 t**



Machine Type PU IV

Output about

equipped with six automatic **precision weighers** feeding of length side seam glued skillets, opening, filling and closing, fully automatically.

50 t

Machine Type PU IIIs

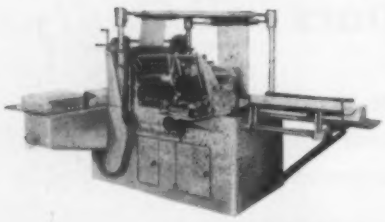
Output about

equipped with a **plate type volumetric filler** and working from the pre-glued skillets, which are opened, filled and closed, fully automatically.

100 t

Parcelling Machines

– can be supplied for direct coupling to packaging machines – thus contributing to lower packaging costs.

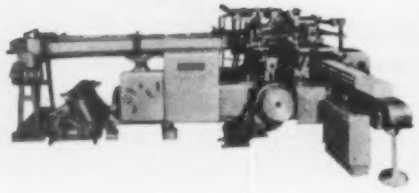


Parcelling Machine Type SP

Output

wraps a pre – determined number of individual packages into Kraft paper, which can be printed on the machine.

up to **72** parcels per min.



Parcelling Machine Type WXO

is working on the same principle as described for the machine type SP. Due to its higher capacity, the machine will take the output of several packaging machines.

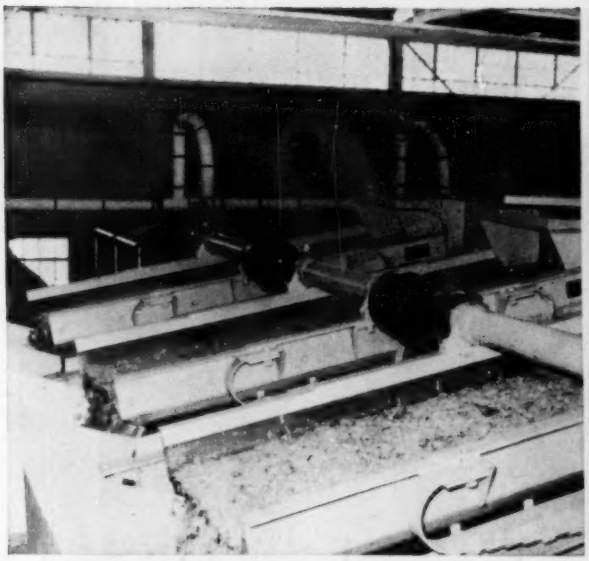
up to **30** parcels per min.

162

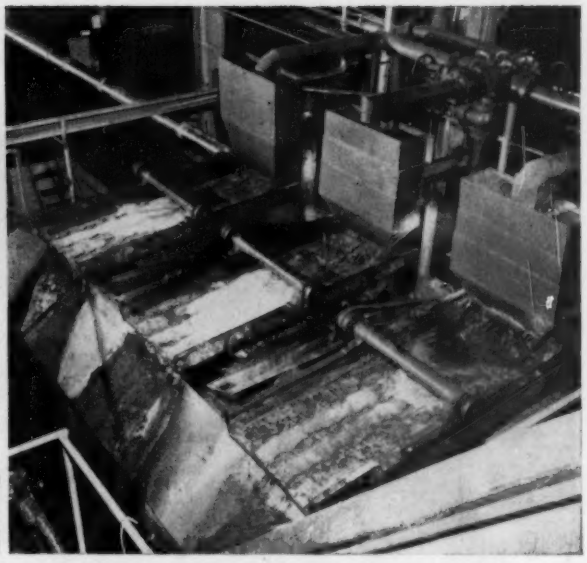
The parcels produced on these machines have a tight wrap and being firm and resistant, lend themselves ideally to piling when storing.

Representative in the United Kingdom: **JAHN (MASKINER) LTD., 34 York Way, Kings Cross London N.1**

FR.HESSER MASCHINENFABRIK AKTIENGESELLSCHAFT STUTTGART-BAD CANNSTATT, GEGR. 1861



PRIMARY SCREENING. Four Link-Belt liquid vibrating screens provide high-capacity handling of primary juice at this mill. Screen cloth is 20 mesh stainless steel.



SECONDARY SCREENING. Equipped with 30 x 30 mesh screen cloth, these three Link-Belt liquid vibrating screens process secondary juice at a rate of 250 to 275 GPM each.

Primary screening to final refining . . . modern mills

use LINK-BELT liquid screens

High-frequency vibration with small amplitude assures high efficiency, less cloth clogging

CANE juices come cleaner . . . faster . . . and *at lower cost* with Link-Belt liquid vibrating screens. In mills throughout the world, these efficient, long-life units are first choice for fine separation of raw mill, secondary and hot clarified juices.

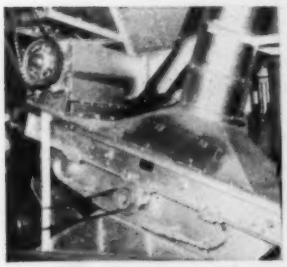
With their special deck design, Link-Belt liquid vibrating screens can use very fine screen cloth. This feature—plus high-frequency, small-amplitude vibration—assures maximum passage of liquid, minimum cloth blinding. Also important, the amount of vibration is easily adjustable to suit varying densities.

In addition to liquid screens, Link-Belt offers a variety of other vibrating screens ideal for scalping, cooling and bagasse handling operations. For complete details, contact your Link-Belt representative or write us direct. Ask for Catalog 2640.

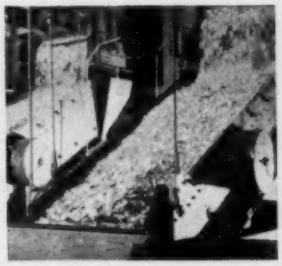
LINK-BELT

LIQUID VIBRATING SCREENS

Other sugar mill operations utilizing LINK-BELT vibrating screens



SCALPING AND COOLING are done by this Link-Belt UP vibrating screen. Bottom hopper is louvered so air can pass through sugar.



DOUBLE-DECK Link-Belt CA vibrating screens efficiently handle bagasse. Top deck breaks up bed of material, bottom deck removes pith.

MELTED SUGAR passes over Link-Belt liquid screens prior to clarification. Each screen can take peak loads in excess of 225 GPM.

HOT JUICE discharged from clarifier is thoroughly cleaned of solidified impurities by this battery of Link-Belt liquid vibrating screens.

LINK-BELT COMPANY: Engineers • Manufacturers • Exporters of Machinery for Handling Materials and Transmitting Power • Established 1875.
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FOR THE SUGAR INDUSTRY

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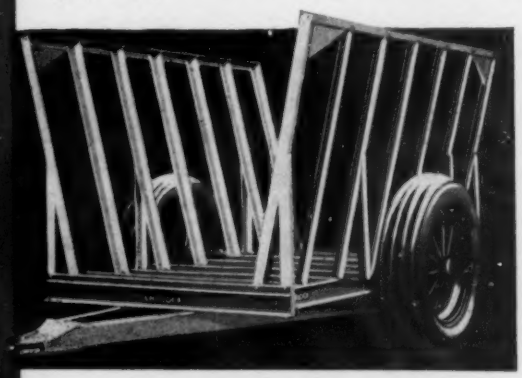
Cut cartage costs with

WHiTLOCK CANE & FRUIT TRAILERS

4-wheel Goose-Neck type of pressed steel construction with extra heavy bracing for loads up to 6 tons.



A low cost model on large diameter wheels for loads up to 5 tons.

Our factory representatives are at the moment travelling the cane growing areas and may be visiting you personally.

Whitlock Cane Trailers are backed by many years experience and will stand up to the job.

Ask for catalogue HC 41 and send details of your requirements.

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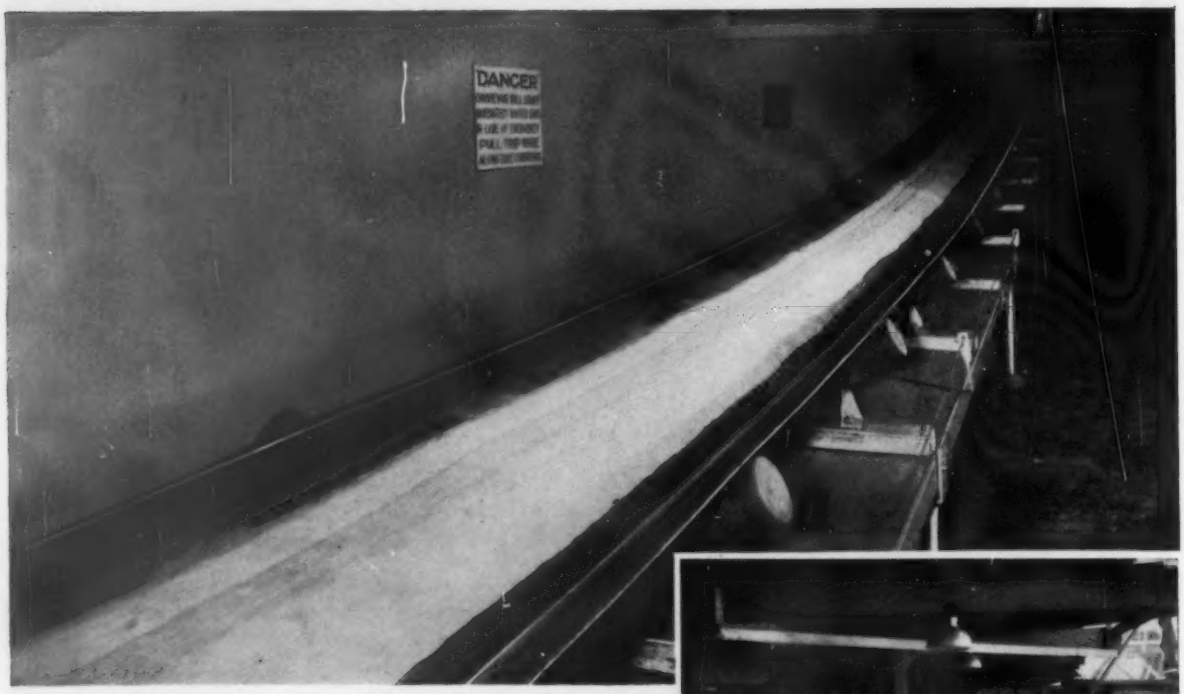

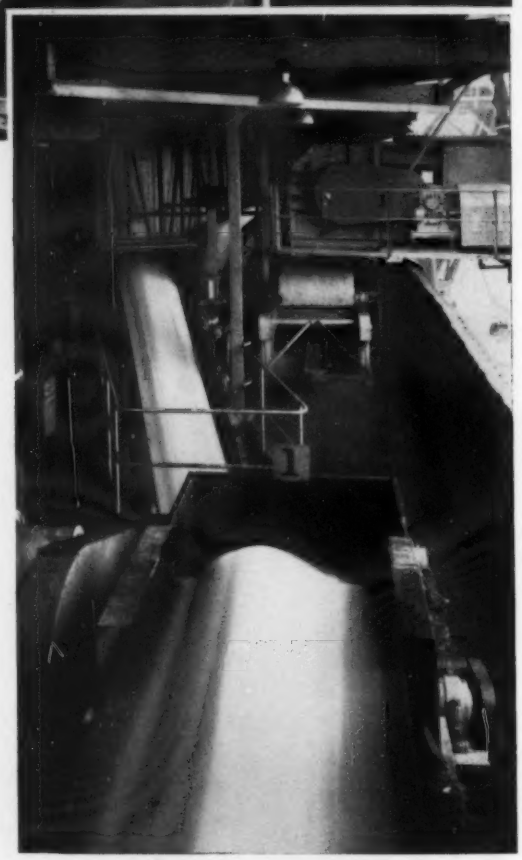

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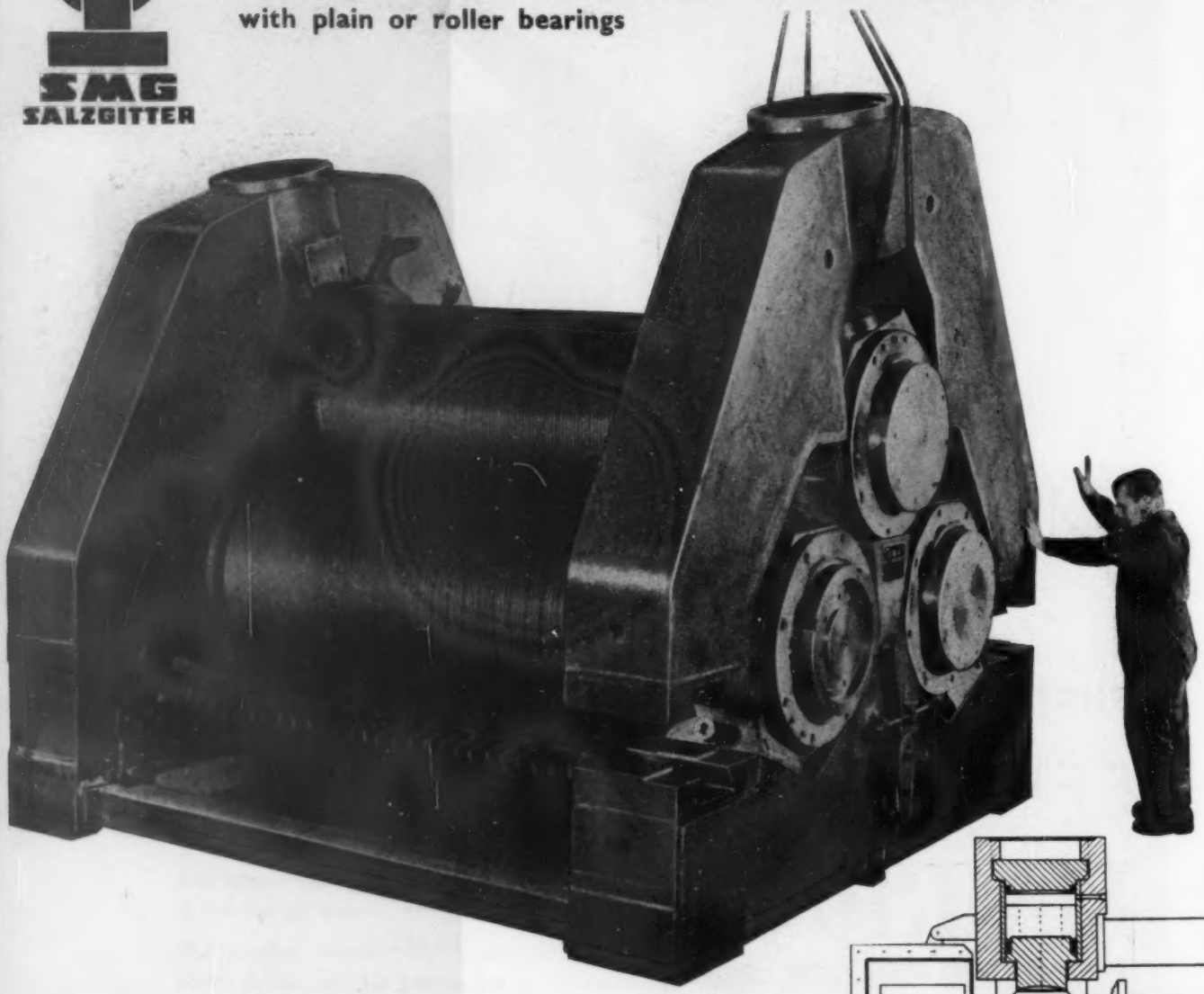

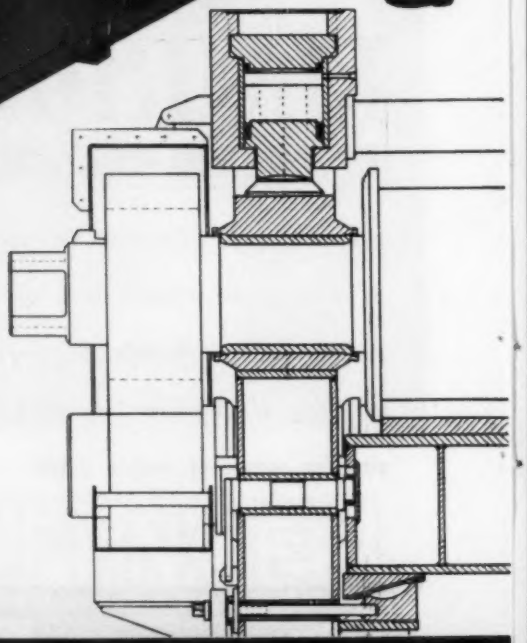

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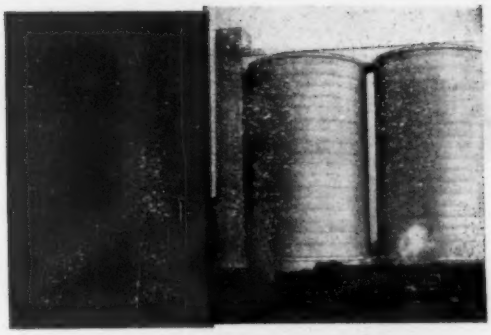

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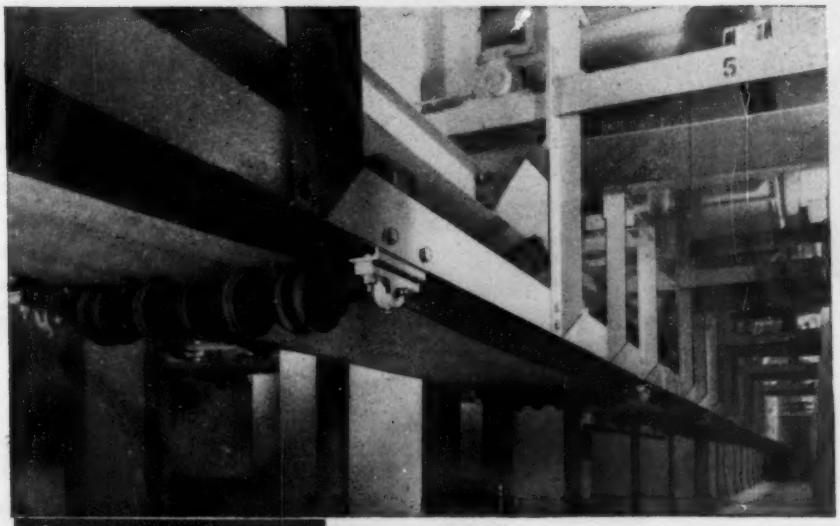

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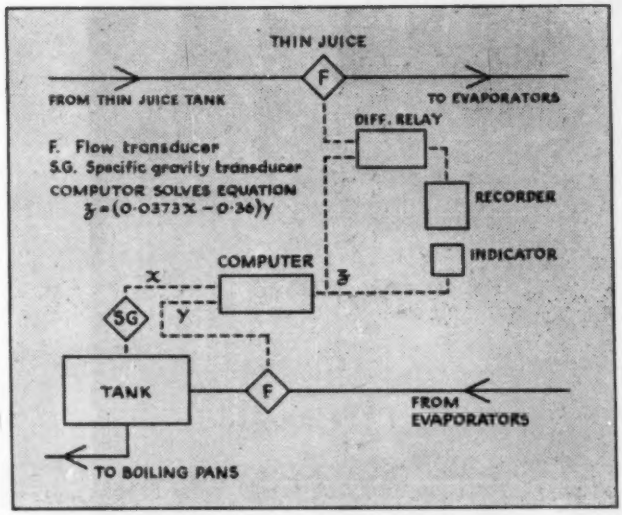

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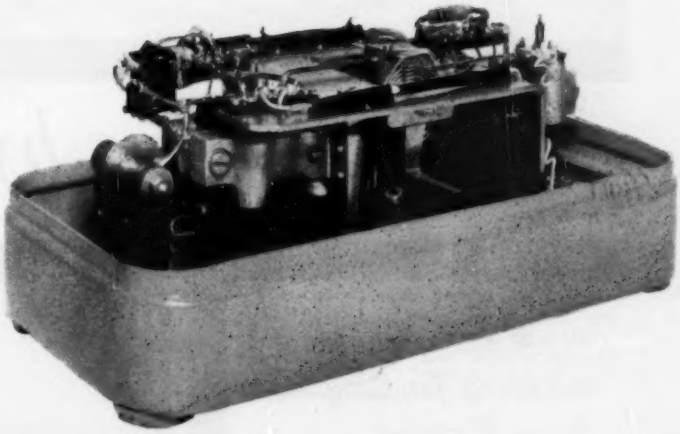

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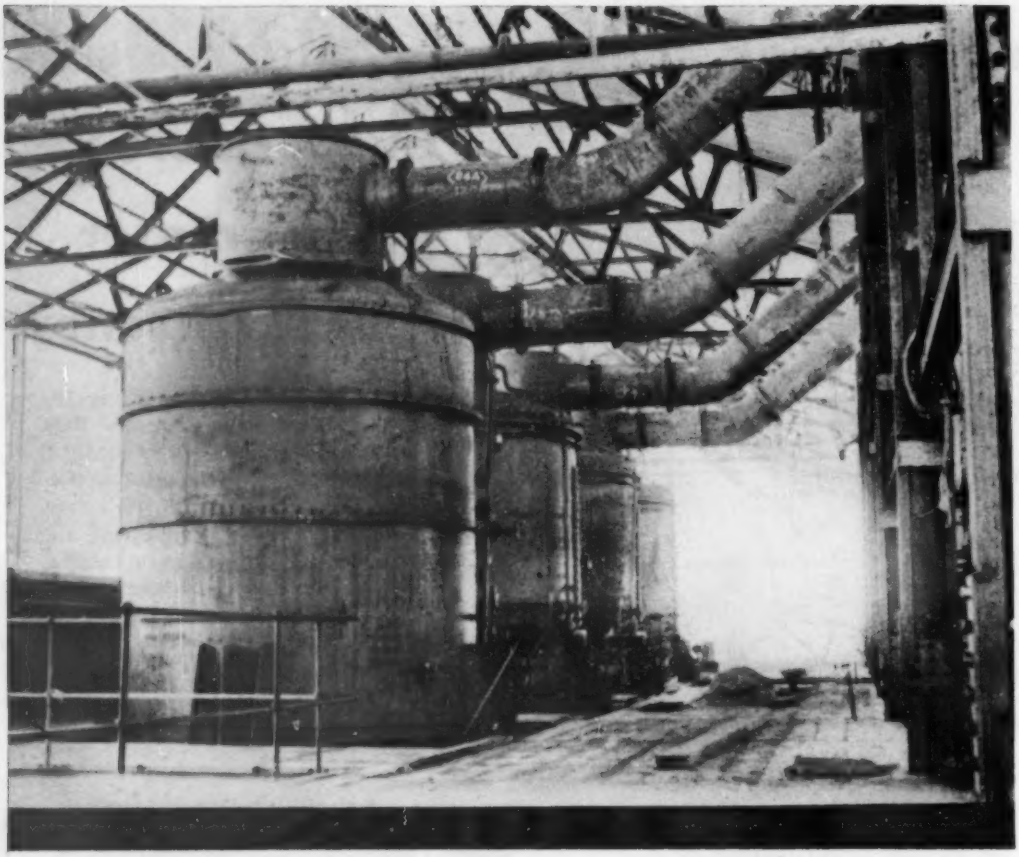

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXI SEPTEMBER, 1959 No. 729

NOTES AND COMMENTS

The Sugar Market and the Sugar Council.

The free market price of raw sugar dropped gradually through July, recovering slightly at the time of Dr. FIDEL CASTRO'S "resignation" but continuing its drift thereafter. It was announced in late July that a meeting of the International Sugar Council for the exchange of views would be held on the 30th July and the following communique was released on 1st August:

"The Executive Committee of the International Sugar Council has met in London on July 30th to August 1st for an exchange of views on the world market situation.

"The Committee agreed that no new developments have taken place which should lead it to modify the conclusion reached by the Council at its last session that requirements and supplies for the year 1959 are roughly in balance.

"It is, therefore, the considered opinion of the Committee that price levels which have recently been ruling in the world market cannot be explained by the overall statistical position.

"The Committee has had a helpful and comprehensive exchange of views on marketing policy. It has noted with satisfaction the aim of exporting countries to pursue a constructive marketing policy in accordance with the objectives of the Agreement with a view to restoring confidence in markets.

"The Executive Committee has discussed what co-operative action might be taken by the Council in furtherance of these objectives, and measures to strengthen the marketing position of member countries are being recommended by the Committee to the Council at once."

Following this communique, the price steadied, presumably in anticipation of the supporting action implied in the text, but dropped when a Cuban delegate to the Council stated that Cuba would not restrict her sales unilaterally (the current low price has been attributed generally to the large surplus over Cuban sales which may lead to a carryover of up to 1,800,000 tons, according to one New York broker). However, reports that Russia was interested in chartering vessels from Cuba to Black Sea and Baltic ports caused a revival, and it was announced on the 12th August that the Cuban Institute had sold 170,000 tons of raws to Russia at the current market price. In addition, a sale of 20,000 tons to Ceylon has been announced.

According to the International Sugar Council's views, the weakness in the market has been due to lack of confidence and not to the statistical position; consequently it is to be seen whether or not the sale to the U.S.S.R., which had not been previously looked for, together with the measures announced on 18th August, as given below, will be sufficient to lift the spot price above the floor envisaged in the Agreement.

* * *

International Sugar Council Action.

It was announced on 18th August, 1959 that, acting on the recommendation of its Executive Committee, the Council on 14th August adopted the following Resolution :—

"If, in pursuance of a constructive marketing policy in accordance with the objectives of the Agreement, a member exporting country having a basic export tonnage under Article 14 should, at the end of the present quota year, have a quantity of sugar unsold within its quota in effect for the year 1959, such quantity, up to a maximum of 10 per cent of its basic export tonnage, shall be carried forward into 1960, but shall not be charged against its export quota in effect for that year provided, however, that the provisions of the Agreement other than those of Article 19 shall apply to this quantity as if it were a basic export tonnage.

"Any member exporting country which believes that it may qualify under this decision shall submit particulars to the Council in time for the matter to be considered at the session of the Council called to fix initial export tonnages for the year 1960."

In reaching its decision, the Council fully endorsed the opinion of its Executive Committee that price levels which have recently been ruling in the world market could not be explained by the overall statistical position. In this connection, it noted that it was the aim of exporting countries to pursue a constructive marketing policy, in accordance with the objectives of the Agreement, with a view to restoring confidence in markets. The decision of the Council is designed to

strengthen the marketing position of these countries by relieving them from the obligation to market the entire balance of their 1959 quotas before the end of the present quota year, not only by exempting them from penalties, but by allowing a carry-forward of quotas regardless of market conditions. Quantities to be carried forward into 1960, within the maximum 10 per cent of basic export tonnages, will be determined by the Council.

* * *

Colonial Sugar Refining Co. Ltd., 1958/59 Report.

Production of raw sugar from the C.S.R. Company's 12 raw sugar mills in Queensland, New South Wales and Fiji reached 500,200 tons in the 1958 season, with record production in each of the three areas. The financial results were rather disappointing in relation to this large production. The greater the quantity of raw sugar produced, the greater becomes the quantity for sale on the basis of the world free market price. This is a low-priced category of sales, and therefore, as production increases, the average price declines. In addition, the world price was considerably lower for the 1958 season than for the previous season.

RAW SUGAR PRODUCTION AT THE COMPANY'S MILLS

Tons Actual Sugar

	N.S.W.	*Queensland*	*Fiji*	*Total*
1957 ..	35,600	239,600	196,100	471,300
1958 ..	56,400	245,500	198,300	500,200

Australian Mills : The Company owns 7 of the 34 raw sugar mills in Australia—3 in N.S.W., 4 in Queensland. Production of all mills in the Queensland industry has long been controlled by a quota system in order to avoid over-production. The aggregate quota for the Company's four Queensland mills represents 18·8 per cent of the total Queensland quotas in 1958.

A pleasing feature of the 1958 season was the recovery of production at the New South Wales mills and the establishment of a new record.

The estimates for 1959 at the Company's Australian mills indicate a large crop. However, as the International Sugar Agreement restrictions on exports continue in force, it may not be possible to harvest the whole of the available cane ; restrictions are expected to apply to C.S.R. mills and to others in Queensland.

The three mills in New South Wales and two in Queensland are delivering their raw sugar in bulk. A third Queensland mill will go over to bulk in 1960. The fourth, Hambledon, near Cairns, together with two non-C.S.R. mills shipping through that port, will remain on bagged sugar for export to certain overseas markets which are not yet ready to receive in bulk.

Bulk equipment at the mills is owned by the mills.

Fiji mills : The Company owns all the 5 raw sugar mills in Fiji. As previously announced, Nausori, the oldest mill in Fiji and the smallest there but one, is to be closed down at the end of 1959. The high sugar output for 1958 was made from a crop of cane grown under drought conditions. That the crop was so satisfactory in those conditions is attributable to the increased proportion in this crop of new hybrid varieties of sugar cane bred by the Company. These canes have shown resistance to drought and have given high yields per acre; the 1958 crop would have been much smaller if the old varieties of cane only had been grown.

Growing conditions for the 1959 crop have been favourable and it is estimated that the crop is large enough to produce at least 250,000 tons of raw sugar. Production at this level would result in a large carry-over of raw sugar stocks at the end of 1959; also, for the reasons already given, such a large crop would result in a low average price for raw sugar.

Currently Fiji has an annual export quota under the International Sugar Agreement of 179,000 tons and a local market of about 15,000 tons, making a total of 194,000 tons which is termed the "quota level".

In view of the striking increase in the productivity per acre brought about by the new cane varieties, and by improvements in drainage and agricultural practice, it is evident that Fiji, even without Nausori, has reached a stage of over-production. This is confirmed by the very large tonnage of cane grown for harvest this year.

It is important to note that it is not a question of looking for new customers and new markets for Fiji's raw sugar because the limitations arising from the International Sugar Agreement make it impossible to export to any markets in excess of the physical quantities provided for by the Agreement.

Looking to the future it can be seen that, if control of production is not exercised, large quantities of surplus cane will be grown and will have to be left unharvested in the seasons to come after 1959, since markets would not be available for the raw sugar such cane would produce if harvested and milled.

Close control of raw sugar production, also of areas under cane and of actual production of cane on a basis equitable to growers, will now be required in Fiji.

Bulk raw sugar at refineries. The refineries in Sydney, Melbourne, Adelaide and Auckland now receive their raw sugar in bulk. A new mechanized bulk unloading plant and a new wharf are under construction at Melbourne refinery. When this installation is completed, bulk raw sugar handling at the three largest C.S.R. refineries will be on a fully mechanized basis. Adelaide is partly mechanized and received its first cargo of bulk raws early in May. Brisbane refinery receives part of its raw sugar in bulk. Cottesloe refinery, near Perth, still receives its raw sugar in bags. The refinery installations are, of course, owned by the Company.

THE SUGAR CANE IN SOUTH AFRICA

THIRTY-FIRST CONGRESS, SOUTH AFRICAN SUGAR TECHNOLOGISTS' ASSOCIATION, 1957.

TWO summaries by J. L. DU TOIT, one of the weather for the year ending May 1957, and the other of the agricultural data for the year 1954–55, have their main interest as records of the past. The latter indicates the influence of varietal change in counteracting the deterioration which appears to be accepted almost universally as inevitable. As P. G. C. BRETT aptly puts it in his paper on recent developments in sugar cane breeding, "the breeder is in the position of the Red Queen, having to run faster and faster to remain in the same place." He briefly traces the development since Uba began to be replaced first by Co varieties, particularly Co 281, imported from India, and these, in turn, by N : Co varieties raised from seed imported from India. He gives weighty evidence, based on the fact that few of the seedlings raised surpass, though many approach, the yielding capacity of present commercial varieties, for his preference for limiting the number of first selections and concentrating on the later stages of selection. The last Co variety to be distributed, Co 331, is already declining and is likely to be replaced by N : Co 376. Other seedlings of promise are briefly noted.

FERTILIZERS

J. L. DU TOIT notes the considerable change in fertilizer practice, from a $P_2O_5 : N : K_2O$ ratio of 100 : 33 : 13 in 1951 to 100 : 113 : 88 in 1955. The experiments described fully justify this change.

DISEASES

Gumming disease, due to the bacterium *Xanthomonas vasculorum*, was first identified in Natal in 1956 in one field recognized to be a "problem" field. With strict quarantine for the last 30 years, its mode of entry can only be guessed, but it seems probable that it has long been present but unidentified owing to the resistance of the former commercial varieties; with the more susceptible N:Co 310, it has declared itself. A survey of 689 farms showed some 14%, and these widely scattered, to be definitely infected, others suspect; and the large majority of the infections occurred on N:Co 310. It may be that unusual weather conditions were responsible for the outbreak which may disappear with a return to normal conditions.

N. C. KING and J. DICK checked the validity of 4 methods for testing resistance to mosaic, and a record of the results is given. The 4 methods are : replicated field trials with interplanted infected and mosaic-free cane and with mosaic-free cane interplanted with maize artificially inoculated, glass-house tests with cane inoculated by abrasion and with caged aphids from infected maize plants. The results suggest that some varieties are genetically susceptible but, under natural contitions, perhaps because less attractive to aphids than alternative foods, maintain immunity. The same conclusion was reached by earlier experiments with streak disease.

WEED CONTROL

The subject is covered by 3 papers. Three experiments at Tongaat, designed to give control, mainly of nut grass, till cane closes in, are described by T. G. CLEASBY. The results were not very conclusive, particularly when costs were taken into account, and, with post emergence treatment, success was influenced by the weather; the same difficultiety was found by M. J. STEWART in the case of dry areas. Similar experiments at Illovo are described by G. D. THOMPSON and H. TRICHARDT.

H.M.-L.

SUGAR CANE AGRICULTURE IN CUBA

OF the thirty-eight papers presented to the thirty-first annual conference of the Association of Sugar Technologists of Cuba, 1957, only six are concerned with the agricultural aspects. The results of two variety trials in 1957 are reported by R. BARRETO D., one conducted on Francisco clay and covering plant and two ratoons, and the other on Matanzas clay covering plant cane only. In the former, using POJ 2878 as base (=100), the three leading varieties in yield of sugar are C 525–50 (=141), C 693–47 (=138) and C 104–49 (=124), but the first owes its position to the heavy yield of cane in the plant crop. In the latter, ten varieties surpassed POJ 2878 in sugar yield, the three leading being H 37–1933, C 89–51 and C 236–51, all holding their positions owing to high cane yield.

A plea is made by E. BOLAÑOS C. for a better recognition of the rôle played by organic matter in maintaining the fertility of the soil and he suggests a fuller use of factory wastes. From the dictum, "no water, no cane", R. BERNAL C. is led to describe the rainfall at Central Unidad during the last 32 years. The area concerned lies on the North coast, extends some 50 km inland and to a height of 400 ft and is backed by mountains rising to over 2000 ft, and records have been kept at five gauges well distributed throughout the area. Rainfall shows considerable differences both from year to year, seasonally

and in distribution, and the effect of these differences on production are discussed in some detail.

The three remaining papers are concerned with pests and diseases, and F. VALDÉS B. discusses the risks of new introductions. The system of quarantine is described and a list is given of major potential pests and diseases which it is hoped to exclude. Biological control of the borer, *Diatraea saccharalis*, at Central Baragua by the Cuban fly, *Lixophaga diatraeae*, is described by C. B. CUETO R. The fly was first artificially bred and liberated during 1948–1953 when, satisfactory control having been secured at a total cost of $22,664, the work ceased. In the four subsequent years a slow increase in the intensity of infestation has been observed.

The frequent reference in recent literature to nematodes suggests a growing recognition of the possibility that these pests may be responsible for considerable damage in cane fields. The results of an examination of soil samples and cane roots in two areas are described by F. PINEDA. The samples were taken from areas of poor growth which suggested ratoon stunting disease. The considerable number of species of nematodes isolated, both parasitic and free-living, are listed.

A recent issue of the *Sugar Journal*[1] is devoted to reports on the sugar industry of Cuba. In discussing cultural practices, P. D. HOUSTON points to the diminishing area of virgin land available for extending the area under cane and the need for increasing production from the unit area. A plentiful supply of labour makes it unlikely that harvesting will be mechanized at an early date and the main rôle for mechanization will lie in cultivation. Characteristic of Cuba is the large number of ratoon crops taken, after each of which a mass of trash is left in the field. The major opening for mechanization is the incorporation of this trash with consequent improvement in the physical characters of the soil and subsoil without burying the trash. In a brief comparison of fertilizer costs and sugar yields for fields in two mill areas, L. B. DESCHAPELLES draws the broad conclusion that fertilizers are responsible for an increased yield of over 30%.

In 1929, irrigation from wells was commenced at Central Baragua, using power derived from the Cuban Electric Co. At Central Macareño sprinkler irrigation was introduced in 1951 with the primary object of distributing the "cachaza" (filter-cake). The evolution of the system by which cachaza is now applied to the land at both Centrals, at Baragua in the irrigation water, is described by G. S. GIANELLONI.

L. C. SCARAMUZZA gives an account of the degree of control of the borer, *Diatraea saccharalis*, obtained since *Lixophaga* flies were first released, under his supervision, on the plantations Francisco and Elia in 1953. In the subsequent period, the joint infestation has fallen from 11·4% to 2·5%.

H. M.-L.

AGRICULTURAL ABSTRACTS

Dry Planting of Sugar Cane. HAMDUL AZIZ. *Agriculture Pakistan*, 1958, **9**, (2), 164–169. A comparison is made of the traditional "wet planting" of sugar cane in Pakistan with a method described as "dry planting" which has proved markedly superior with present day varieties giving better germination, higher yields and lower labour costs. It is pointed out that the traditional wet planting method was satisfactory with the old thin stemmed varieties (now outdated) which germinated easily but the newer thick stemmed or Coimbatore varieties do not germinate so readily and the buds need to be moist for a longer time. In the "wet planting" method the setts are placed in moist soil (about 16% moisture) whereas in "dry planting" the setts are placed in dry furrows and then immediately irrigated.

* * *

Sugar Cane Insects in the Rio Turbio Valley. II. The Froghopper (la Candelilla). P. GUAGLIUMI. *Bol. Esta. Exp. Occidente* (Venezuela), 1957, (67), 35 pp.—The present Bulletin covers for the Froghopper (*Aeneolamia* sp.) the same ground as that covered in an earlier Bulletin[2] for the cane borers. From the nature of the insects' habitat in the nymphal condition, biological control has not proved beneficial, though a number of predators are listed. Greater attention is paid to chemical control which is considered at some length.

* * *

C.S.R. Co's Large Scale Breeding. ANON. *Producers' Review*, 1958, **48**, (12), 21, 22.—A brief review of the extent of the breeding work conducted by the Company is given and it is noted that the 1957 crop was composed of Bureau-bred varieties 39·6%, C.S.R.-bred 45·9% and imported canes 14·5%.

* * *

Overproduction of Sugar. N. J. KING. *Cane Growers' Quarterly Bull.*, 1959, **22**, 76–78.—The causes and consequences of overproduction in Queensland, the first for a generation, are discussed. Disposal of the excess cane raises certain agricultural problems. Chopping up and ploughing in prior to the wet season is recommended by the Bureau[3]; experience in Mossman showed little difficulty except in the case of Trojan[4].

[1] *Sugar J.* (La.), 1959, **22**, (8).
[2] *I.S.J.*, 1959, **61**, 101.
[3] *Producers' Rev.*, 1958, **48**, (12), 29.
[4] *Ibid.*, 41.

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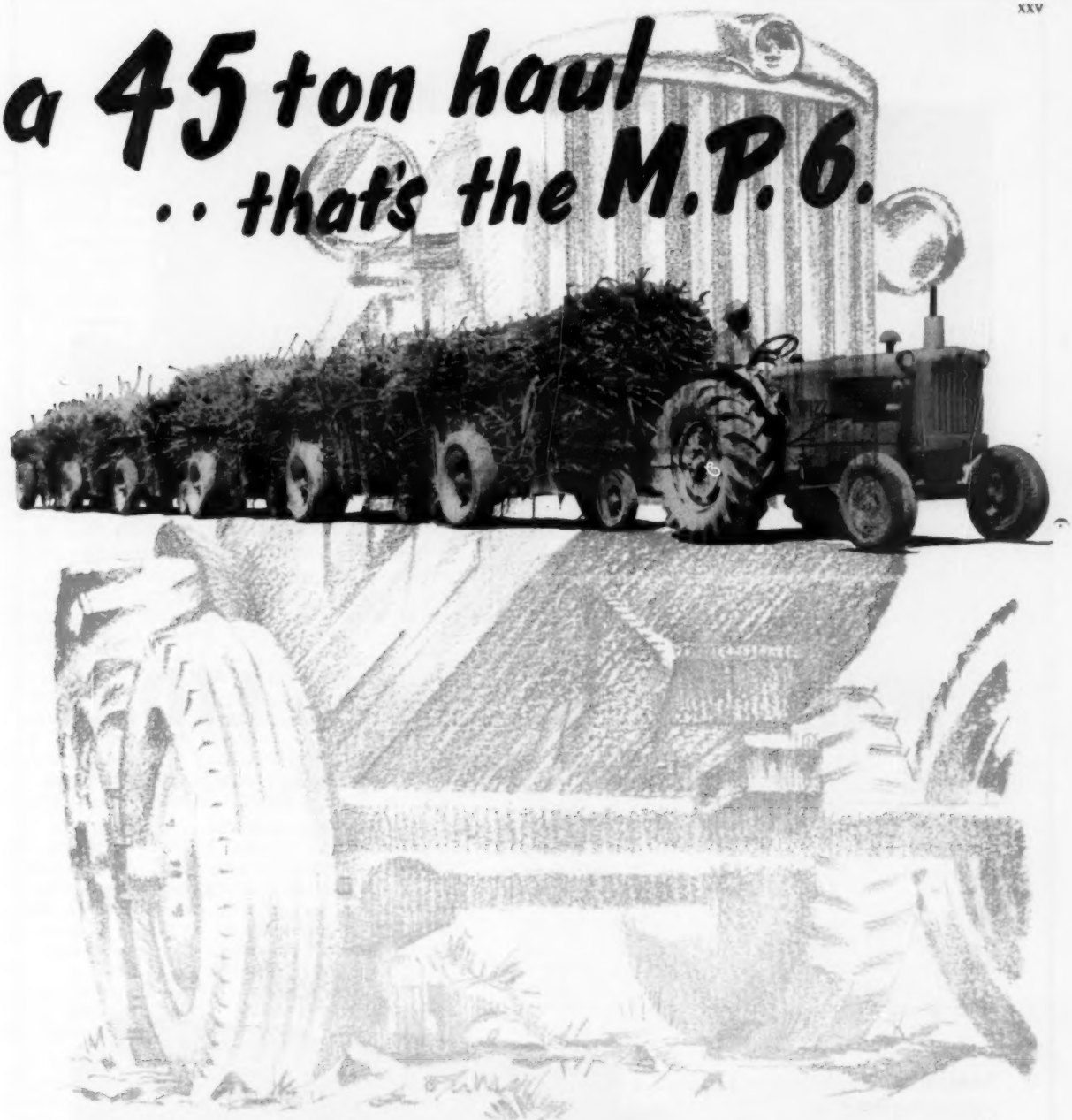

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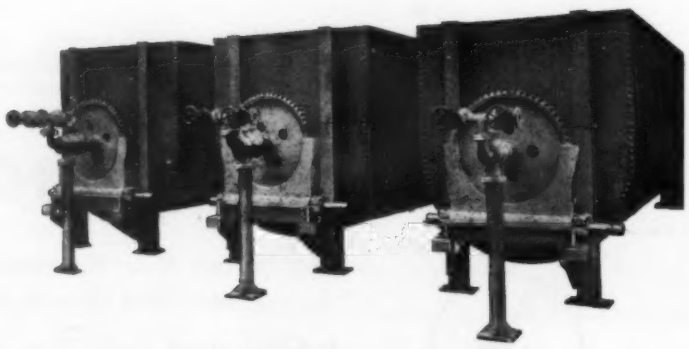

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THE SUGAR CANE IN INDIA

THE discussions at two annual Conventions held in 1958 may be considered together; they are those of the Sugar Technologists' Association of India (twenty-sixth) and of the Deccan Sugar Technologists' Association (fifteenth). At the former Convention 19 of the 27 papers dealt with matters which concern the factory; here the remaining papers are briefly summarized.

A comparison is drawn by K. P. MITTAL between the soils of a forest area at Dehra Doon and a small area brought under cultivation in cane in 1953. Physical and chemical data for the first four 1-ft horizons are given. The forest soil shows greater porosity, water-holding capacity and higher exchange capacity in the upper ft than the cultivated soil, its N is nearly double that of the cultivated soil and lime is equally distributed whereas, under cultivation, it is accumulated in the 4th ft to form a hard-pan. The organic content is not given. In certain soils of Bihar and Madhya Pradesh, S. C. SEN and RAGENDRA PRASAD found both yield and quality to be positively correlated with pH (range 7·5–8·0) and conductivity (range $0{\cdot}10–0{\cdot}15 \times 10^{-3}$). S. C. SEN and his associates also found no over-all significant effect on quality in experiments using 2,4–D (sodium salt) or "Albolineum" (petroleum oil emulsion) as spray though, in a paper read at the latter Convention, a gain from such treatment with 2,4–D is claimed by N. B. PATWARDHAN and T. V. GANPULE. Varietal differential resistance to drought under deficient irrigation in the Gangetic plains is indicated by K. N. S. GALOT.

In a recent paper[1] attention was drawn to the recovery drop in Bihar factories and the need for harvest control. From time to time schemes to this end have been put forward[2] and the prospect of introducing a system based on refractometer sampling is discussed by S. C. SEN who describes in some detail the results of one such survey and the issue of "challans" in accordance therewith. An experimental scheme on similar lines has recently been introduced for the Kirlampudi Sugar Mills and is briefly described by YOGENDRA KISHORE as showing promise.

At the latter Convention a larger proportion of the 30 papers is concerned with agriculture and can only be dealt with cursorily. Notes are given by K. V. JOSHI and V. M. RAO respectively on cultural systems in the Gangawathy Taluka (Hyderabad) and the Nizam Factory Zone (Andhra).

A survey, and the cultural problems associated therewith, of the soils of the latter is detailed by K. V. JOSHI and a like survey of the terraced lands of the Kolhapur District by K. S. PHARANDE and G. T. BABRIWALA shows the association between slope and soil type. R. A. KALE and S. B. KADREKAR find spray application of iron sulphate during vegetative growth more effective than soil applications on iron-deficient soils of Padegaon.

Five papers describe a series of manurial experiments of which the interest is, however, mainly local and the results too detailed to be recorded here. Of more general interest is the description, by K. S. KALE, of a sytem of making compost in "giant pits", 140 ft × 80 ft × 6 ft, the materials used being trash, press mud and cattle dung with, at intervals, boiler ash and light soil.

Studies on the chemical and physical properties of soil include one by G. K. ZENDE and J. S. KHONDI dealing with the availability of manganese in alkaline soils and these studies are extended by the former author and K. S. PHARANDE to cover the soils of the Deccan Canal area in general. M. V. DAHIPHALE and S. V. CHIONCHORKAR describe a rapid method for determining the K status and the latter, with G. K. ZENDE, discusses certain defects in a quick colorimetric method devised by S. P. SETH for determining soil pH.

A single year variety trial at the Saswad Mali Factory by P. M. GOVITRIKAR, and another at Kolhapur by G. K. TONAPY and P. S. KELAVKAR show Co 678 as the leading cane under the rather intensive conditions of the former trial and Co 775 at the latter trial. Varietal susceptibility to rust is discussed by V. M. RAO. Five years' observation suggests that the divergence in susceptibility is of parental origin. Varietal susceptibility to, and methods of control of, mosaic are briefly reviewed by M. J. ALBUQUERQUE and G. T. BABRIWALA. Lastly, what is termed the "grassy shoot" disease of Co 419 is attributed by P. N. SOMAN to a virus partially controlled by hot water treatment but also by using setts from the upper internodes since the virus appears to be concentrated in the lowest internodes.

Eelworms and Sugarcane. J. GORDON. *South African Sugar J.*, 1959, **43**, 27, 29.—Damage due to eelworm is reported in the form of a discussion between the author and J. DICK, centering on *Exp. Sta. Bull. No.* 8 and the various methods of control, biological and chemical.

* * *

"Warfarin" A Promising Rodenticide. S. CHUANG. *Taiwan Sugar*, 1958, **5**, (5), 14–21.—Trials carried to the field stage and covering distribution of baits in the field, are reported. The best carrier of "Warfarin" is rice coated with 2% peanut oil. Pre-baiting appeared of no advantage.

* * *

Some Important Jobs of Sugar Cane Ratoon Crop. P. C. STONE. *Taiwan Sugar*, 1958, **5**, (5), 22–25.—Since 1952, the practice of ratooning has been on the increase. The methods adopted, from cutting, through aligning and ploughing-in the trash, to off-barring are described.

[1] *I.S.J.*, 1959, **61**, 262.
[2] *I.S.J.*, 1957, **59**, 100.

New Varieties Bred in Taiwan. ANON. *Taiwan Sugar*, 1958, **5**, (6), 13–15.—This Report of the Committee for Varietal Regional Trials gives descriptions of 4 new releases, F 141, F 142, F 143, and F 144.

* * *

An Improved Cultivation Method of Autumn Paddy Sugar Cane. H. S. FU. *Taiwan Sugar*, 1958, **5**, (7), 18–23.—Six systems of inter-planting sugar cane and rice are described, of which the sixth is recommended for autumn planting. In it, two-noded cuttings are inserted obliquely in the flooded soil with one node below soil surface and the other in the atmosphere.

* * *

Resistance Trials for Downy Mildew. TEH-LING CHU and YUN-SUN BAU. *Taiwan Sugar*, 1958, **5**, (9), 13–20.—The trials covered 188 varieties, a considerable number of which were highly resistant, including N:Co 310 which occupies 95% of the cane area. Clones of *S. spontaneum*, *Miscanthus*, *Erianthus* and *Narenga* showed no infection.

* * *

Natural Sugar Cane Districts in Taiwan. SHIH-CHUNG WANG. *Taiwan Sugar*, 1958, **5**, (11), 13–18.—The classification of the sugar cane areas is based on climatic characteristics with subdivisions according to soil composition.

* * *

Overhead Irrigation. T. G. CLEASBY. *The Condenser* (Tongaat Sugar Co.), 1958, **4**, (1), 35–41.—The general deficiency of the rainfall in Natal makes irrigation very desirable, and the limited supply available from most of the rivers and the difficulties inherent in surface irrigation in undulating fields all suggest that the advantages lie in overhead irrigation. Tongaat has nearly 4000 acres under the system and the article records both the practical experience obtained in increased crops and sugar with the balance between cost of supply and increased revenue, and data relative to evaporation, the wilting point and water duty as measured under Tongaat conditions.

* * *

High and Low Volume Spraying of Sugar Cane: I. Hand-Operated Machines. B. D. GUPTA and J. P. KULSHRESHTHA. *Ind. J. Sugar Cane Res. Dev.*, 1958, **3**, 22–28.—Low volume solid cone and fan jets are compared in favour of the latter.

* * *

Correlation Studies of Some Agronomic Characters of First Generation Cane Seedlings and their Second Generation Progenies. M. T. ILAGA and V. C. CALMA. *Sugar News* (Philippines), 1958, **34**, 625–630.—The evidence given in this reprint of a paper read at the 6th Post-War Convention, Philippines Sugar Technologists, indicates high positive correlation in the case of stooling performance and the diameter of stalks. No such correlation was found in the case of length of stalks and refractometric Brix.

* * *

An Analysis of Factors underlying Heavy Incidence of the Stalk Borer (*Chilotraea auricilia*). B. D. GUPTA. *Indian Sugar*, 1958, **8**, 209–210, 217–223.—Four years of light attack have been followed by a heavy attack in 1957. Comparisons of environmental conditions suggest that the causes of the outbreak lie in drought and heat at time of moth emergence, followed by heavy rain leading to prolonged flooding, and too heavy nitrogenous dressings producing soft cane under such conditions.

* * *

Red Rot Disease in Sugar Cane. S. K. CHOPRA. *Indian Sugar*, 1958, **8**, 269.—A programme of preventive measures, arranged by months, is presented as additional to the two major control measures, banning cultivation of susceptible varieties and using disease-free planting material.

* * *

Control of Sugar Cane Borer. H. N. MANJAIAH. *Indian Sugar*, 1958, **8**, 273–274.—A system of light earthing up is described, for which a cheap implement has been designed.

* * *

Some Friends of the Sugar Cane Farmer: I. Parasites on the Top Borer. B. D. GUPTA. *Indian Sugar*, 1958, **8**, 439–444.—Four hyper-parasites are described and their potentialities for control noted.

* * *

White Fly (*Aleurolobus Barodensis*) in N.W. Uttar Pradesh. GIRIDHARI LAL. *Indian Sugar*, 1958, **8**, 445–450.—A severe outbreak of this usually minor pest is traced to exceptionally heavy rains associated with a temporary neglect of cultivation pending a programme of consolidation of holdings.

* * *

Recovery Drop in Bihar Factories in Recent Years. K. L. KHANNA. *Ind. J. Sugar Cane Res. Dev.*, 1958, **3**, 10–21.—Recovery has steadily dropped from 10·5–11% to 10·22% in 1954/55, 9·78% in 1955/56 and 9·42% in 1956/57. The drop is partly explained by the replacement of Co 313 by high yielding varieties having poorer juice, but also to the depressing effect of the use of sulphate of ammonia. Harvest control, cutting down of the interval between cutting and crushing, with protection of the cut cane en route to factory requires revision in view of the heavy crush.

SUBSIDENCE IN FLOCCULATED CANE JUICE

By N. O. SCHMIDT *

Department of Sugar Chemistry and Technology, Imperial College of Tropical Agriculture, Trinidad, W.I.

WHEN a flocculated juice sample is allowed to stand so that a well-defined interface is formed between mud and clear juice, the decrease in height of the interface with time is easily measured. The "settling curve" derived from these data is usually made up of an initial linear part followed by a "compression zone" in which the slope of the curve decreases to zero. It is of interest to characterise such settling curves but so far this has only been possible on an empirical basis. As has already been shown[1], for the cane juices examined in this laboratory, the final part of the compression zone takes the shape of a rectangular hyperbola; a similar hyperbolic relationship has been found for Australian juices[2] and also for mineral phosphate slimes[3]. The determination of the hyperbolic constants t_0, R and H_∞ from settling experiments has already been indicated[1]; it was suggested that while R characterised the rate of compression, H_∞ represented the quantity of mud. In the present account, the results of a more detailed investigation are described, and it will be shown that a slightly modified interpretation of R and H_∞ is required.

Experimental

Juice obtained by milling cane in a laboratory 3-roller mill was filtered through cotton wool in order to remove bagasse fragments and other coarse material. Sufficient calcium chloride and sodium phosphate were added to ensure a "clarified juice" of high clarity and the mixture adjusted to pH 8 with sodium hydroxide. Juice samples were boiled for not less than 5 min. before pouring into the settling tubes.

The flat-bottomed "Pyrex" settling tubes were 4·8 cm in diameter and 42 cm long; each was fitted with a rubber bung which carried a thermometer and a glass stirrer. Eight such tubes were mounted in a glass-fronted waterbath maintained at 90°C. It was found that this arrangement gave much better temperature control than the steam bath used previously[1].

Each boiling juice sample was poured into the appropriate tube and stirred until the temperature had fallen to that of the water bath. The stirrer was then withdrawn and mud level readings commenced; these were continued until the settling velocity had dropped below 0·01 cm/min. In most juice systems, as will be described below, when the settled mud was remixed with its clarified juice and the settling measurements were repeated, it was found that the original settling curve was reproduced—a demonstration that in such systems the floc is not changed on compression. Accordingly, it was reasonable to effect changes in the initial height (h_0) and in the initial mud concentration (c_0) by remixing the contents of a settled tube after adding or withdrawing clarified juice; in this way both h_0 and c_0 were varied while the total quantity of mud present (h_0c_0) was kept constant. When the new initial height was h_0' and the new initial mud concentration was c_0', then, for tubes of cross-sectional area a:

$$c_0h_0a = c_0'h_0'a.$$

In this work, c_0 in the original juice sample has arbitrarily been put as unity, so that the new initial concentration is simply given by:

$$c_0' = \frac{h_0}{h_0'}$$

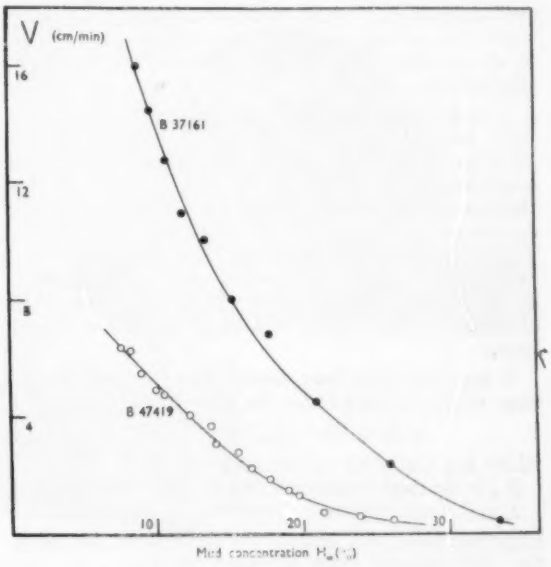

FIG. 1.—Relation between initial constant settling velocity V and mud concentration H_∞.

The total quantity of mud present was changed by replacing clarified juice with more of the original unsettled juice and remixing the settled mud with this. If h cm of clarified juice were replaced, then on the above basis:

$$c_0' = \frac{h_0 + h}{h_0}$$

Several experiments were carried out to study the effects of slow stirring during subsidence; the various types of stirrer tried were driven by an electric motor at 0·1 r.p.m. In almost every case it was found that

* Present Address: A/S De danske Sukkerfabrikker, Centrallaboratoriet, I Langebrogade, Copenhagen K, Denmark.

[1] SCHMIDT: *Proc. 8th Congress I.S.S.C.T.*, 1953, 729.
[2] BOSWORTH *J. Colloid Sci*: 1956, **11**, 496.
[3] SMELLIE and LA MER: *J. Colloid Sci.*, 1956, **11**, 720.

when the mud became compressed, the mud level was disturbed by the stirrer, making further accurate measurements impossible ; for some juices, the whole mass of compressed mud turned with the stirrer. All settling results quoted here were therefore determined by allowing the mud to settle without stirring.

Results and Discussion

When a freshly limed and boiled juice is left to settle, the mud consists initially of very small flocs which gradually agglomerate into larger flocs. The time which elapses before the ultimate floc size has developed varies from one juice to another and times up to 10 minutes have been observed. With comparatively long times of agglomeration, the settling curve is not linear initially, although, once the ultimate floc size is reached, a linear rate of settling can usually be observed before the compression zone is entered ; if, as frequently happens, the agglomeration time is relatively short, the linear part of the settling curve is well-defined and, when extrapolated makes an intercept of h_o on the h axis. In either case the velocity, V, of the mud interface over the linear region can be determined.

It might reasonably be expected that V, for a given juice, would depend on the existing ratio of mud to clear juice. In Figure 1 the variation of V with mud concentration is shown for two juices and it is seen that the velocity V falls off quite markedly as the mud concentration increases. Such curves as those in Figure 1 are interesting from many points of view, but they are somewhat tedious to obtain and generally do not fit any simple empirical equation ; only single, complete settling curves will therefore be considered here.

It has previously been found[1] that the compression zone of the settling curve fits a hyperbolic relation :

$$(t + t_o)\ (h - h_\infty) = k \qquad \ldots\ldots\ldots\ldots (1)$$

where h is the height of the mud at time t
h_∞ is the final height of the mud (after infinite time)
t_o and k are empirical constants.

Experimentally, h_∞ and k are determined by using the differentiated form of equation (1) :

$$h - h_\infty = \sqrt{(kv)} \qquad \ldots\ldots\ldots\ldots (2)$$

where v is $-dh/dt$.

By plotting h against $\sqrt{v}$ a straight line is obtained with intercept h_∞ on the h axis and slope $\sqrt{k}$. The value of h_∞ is clearly a measure of the volume of mud present and $\sqrt{k}$ is related in some way to the settling rate ; the lower the value of k the faster the mud settles. In the original paper[1], the two parameters H_∞ and R were defined as follows :

$$H_\infty = 100\, h_\infty / h_o \qquad \ldots\ldots\ldots\ldots (3)$$

$$Rh_o = 100\ \sqrt{k} \qquad \ldots\ldots\ldots\ldots (4)$$

Graphs of h against $\sqrt{v}$ are shown in Figure 2 (a) for two juices in which both h_o and c_o were varied ; in each case the total amount of mud in the settling tube, $c_o h_o$, was constant and it will be seen that all the results for a given juice lie on one straight line. Thus, whatever the values of c_o and h_o, so long as the product $c_o h_o$ is constant, the settling curve is characterised by unique values of h_o and k. This conclusion has been tested by many other experiments on cane juices and has been found to apply to almost all the juices examined. However, exceptional juices are sometimes found in which there is a marked deviation from linear behaviour ; when the mud is resuspended and settled again, a markedly different settling curve is obtained. An example of this behaviour is given in Figure 2 (b) ; such abnormal curves, which must be associated with fundamental changes in floc structure, are of considerable interest but in the present account only juices behaving as in Figure 2 (a) will be discussed.

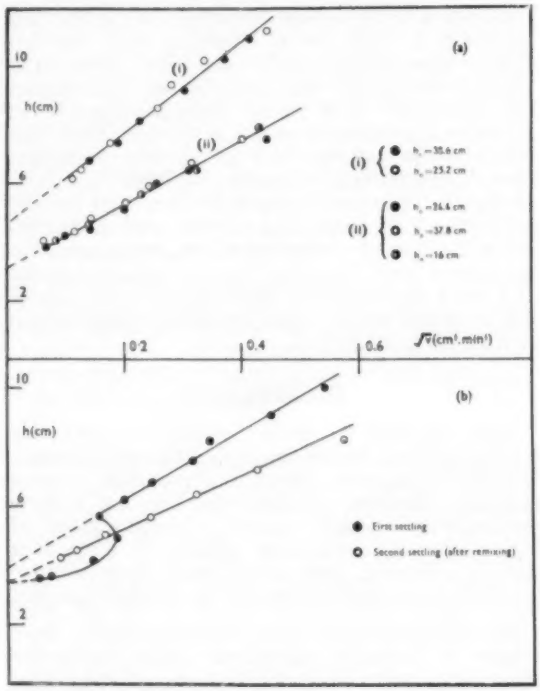

FIG. 2.—Relation between h and $\sqrt{v}$ for different systems.
(*a*) Resettling from different heights—curve (i), h_o = 38·6 cm, 25·2 cm as curve (ii), h_o = 24·4 cm, 37·8 cm, 16·0 cm.
(b) change in behaviour of a sample of BH 10/12 during first settling and second settling (after remixing).

Figure 3 (a) shows a typical graph of the final height of mud, h_∞, against $c_o h_o$, the total amount of mud in the tube ; it can be seen that whilst h_∞ varies linearly with the amount of mud present, the graph does not extrapolate to the origin, suggesting that the mud is compressible. It may be noted that these, and other results not described here, are at variance with the assumptions made in the Kynch treatment of settling curves[4]. The relationship shown in Figure 3 (a) is :

$$h_\infty = A + B\, c_o h_o \qquad (5)$$

where A and B are constants. The value of A varies

[4] *Trans. Faraday Soc.*, 1952, **48**, 166.

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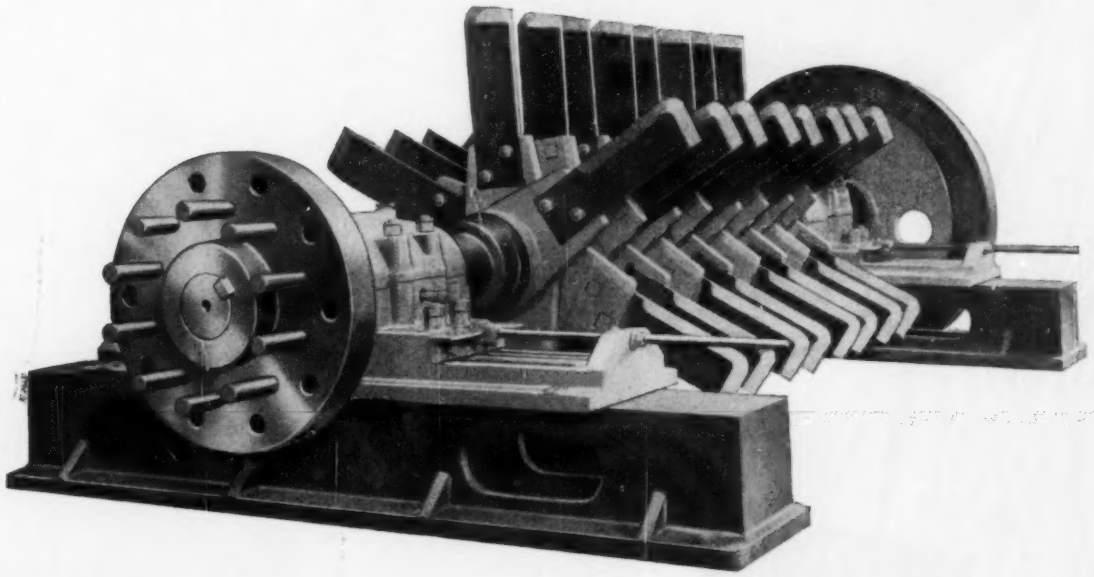

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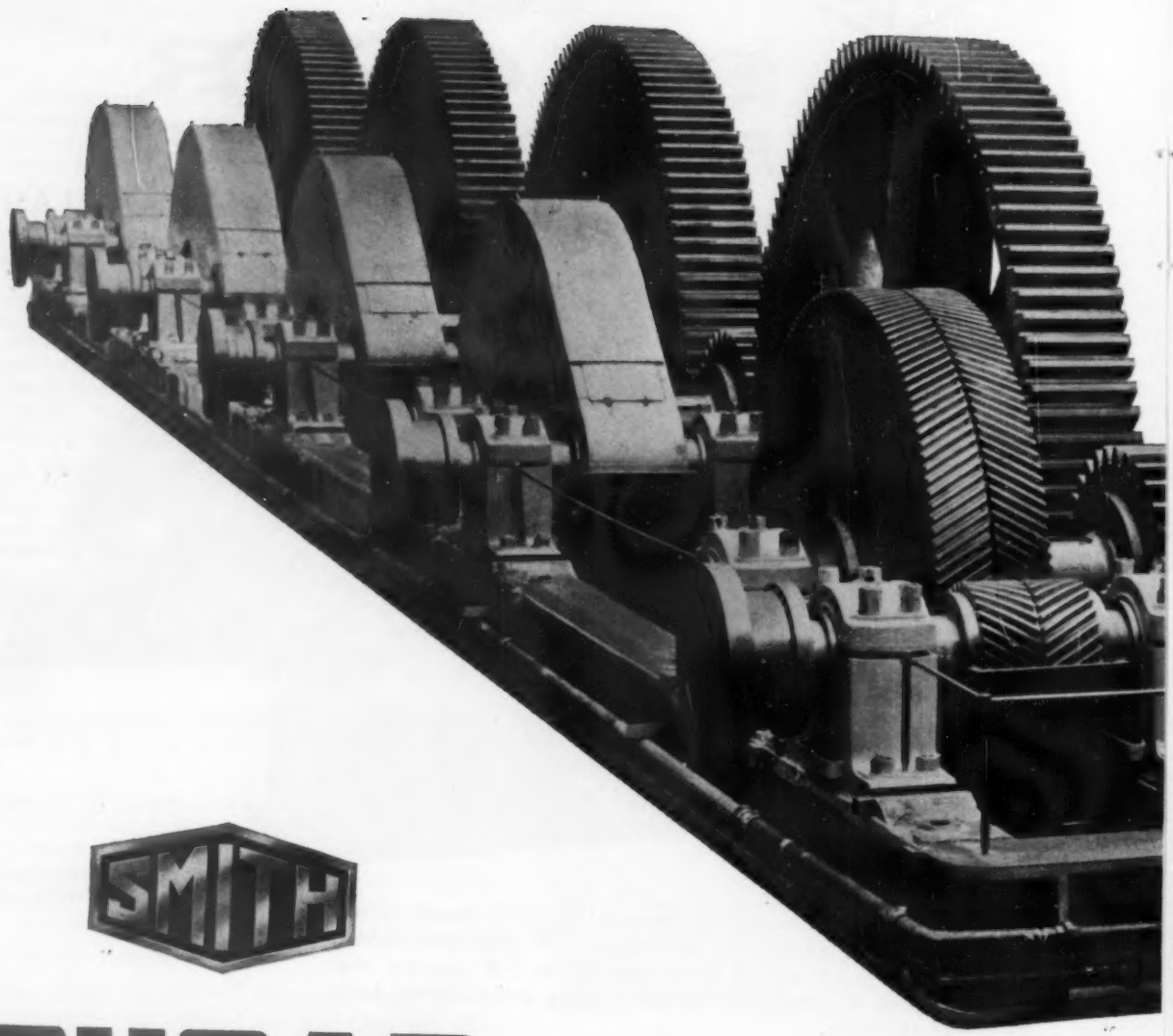

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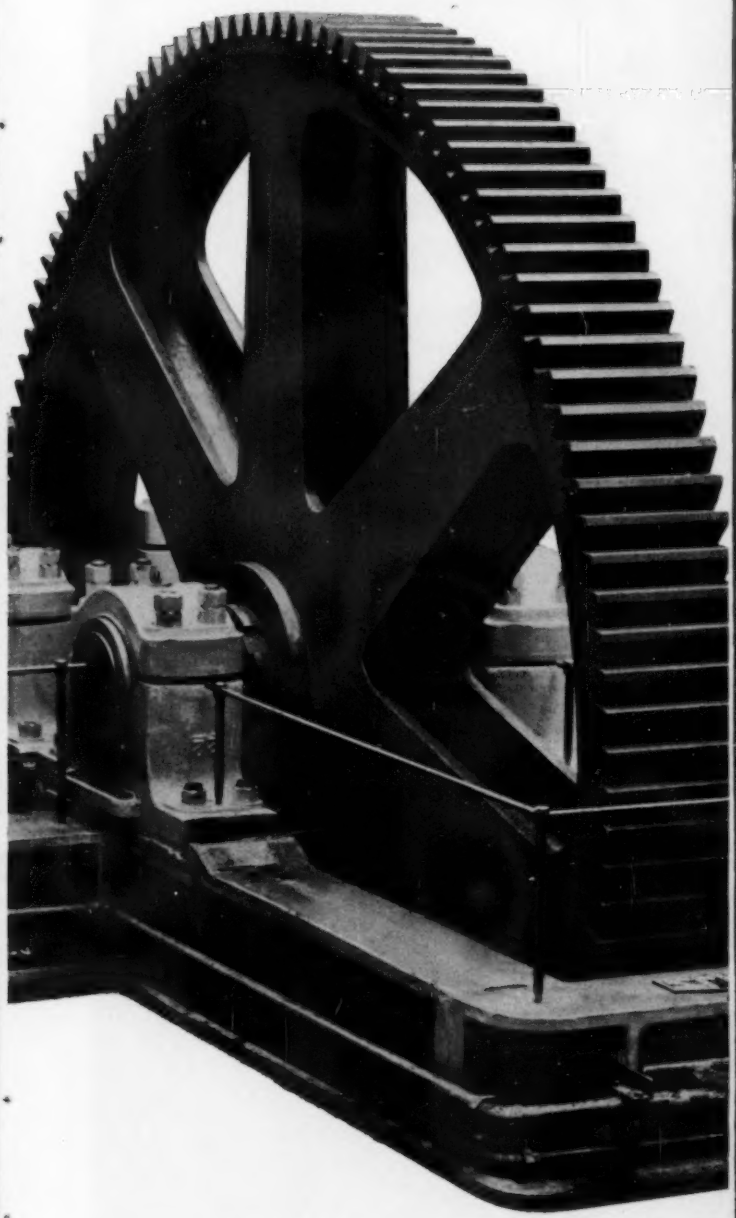

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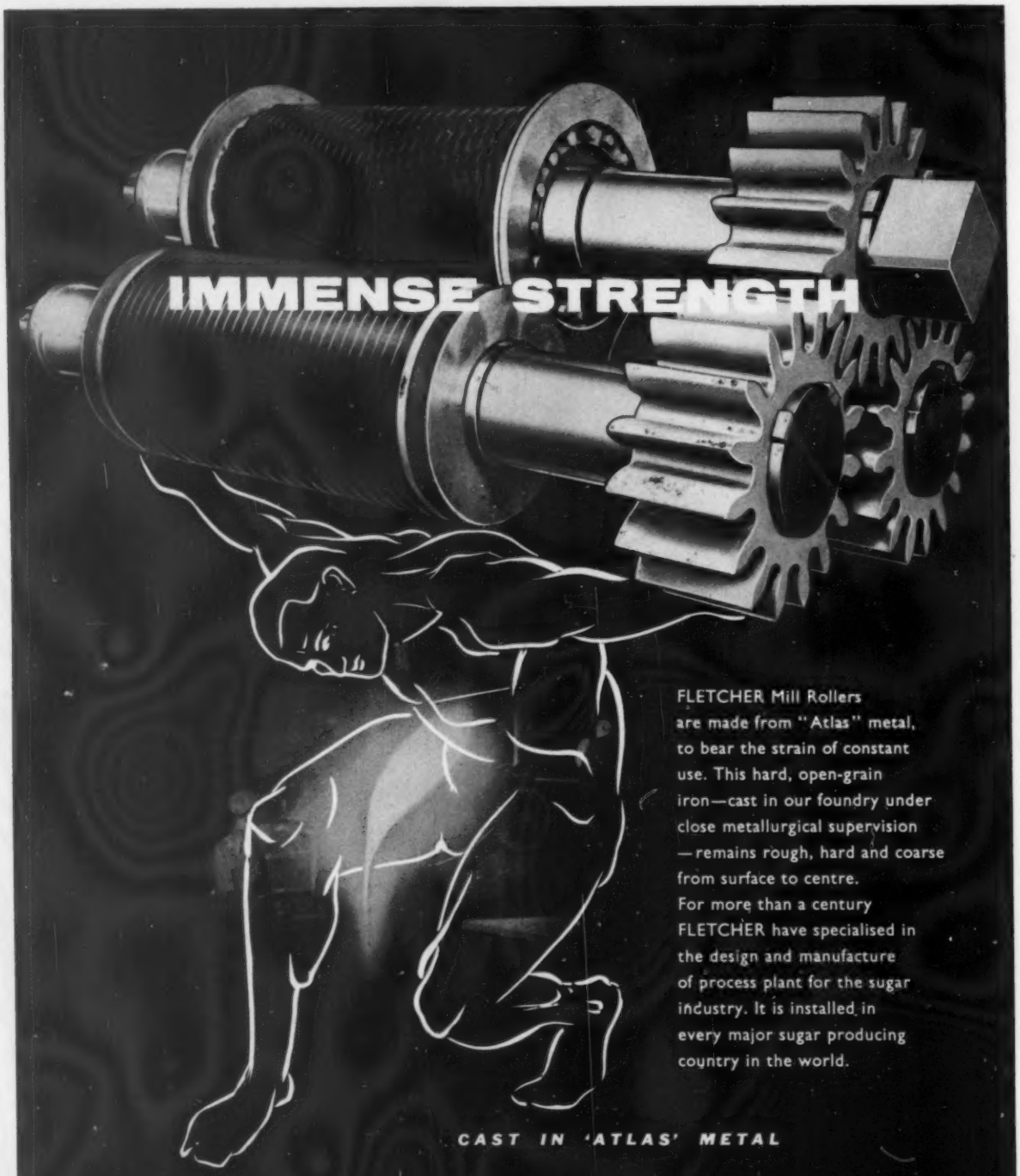

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from juice to juice and normally is in the range from 0 to 1 cm. In Figure 3 (b) typical results are shown for the variation of $\sqrt{k}$ with amount of mud in the tube ; in this case, $\sqrt{k}$ varies almost linearly with $c_o h_o$ and the lines, when extrapolated, pass through the origin so that these results are of the form :

$$\sqrt{k} = D\, c_o h_o \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where D is a constant.

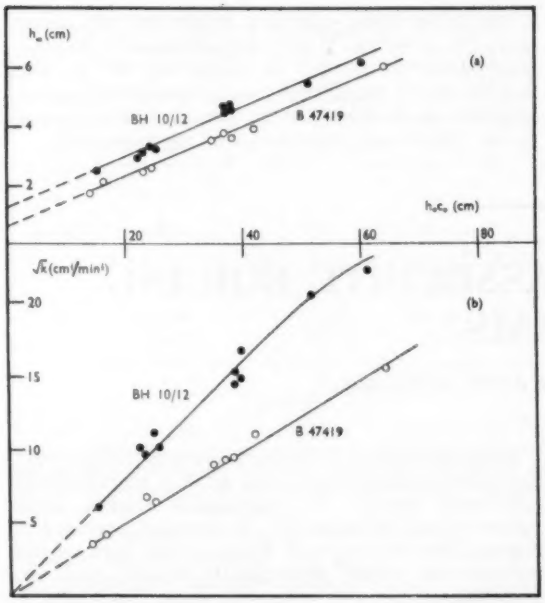

FIG. 3.—h_∞ and $\sqrt{k}$ vs. the total quantity of mud $h_o c_o$.

At high values of $c_o h_o$ the linear relationship of equation (6) begins to break down, but for the usual experimental range this relationship is a reasonable approximation. It may be of interest to mention that equations (5) and (6) have also been found to hold for precipitates of calcium phosphate produced by adjusting to pH 8 a solution of calcium chloride and phosphoric acid.

If equation (5) is divided by h_o we obtain, using equation (3) :

$$H_\infty/100 = A/h_o + Bc_o \quad \ldots\ldots\ldots\ldots (7)$$

From equation (7) it is clear that the value of H_∞ for a given initial concentration c_o will depend on the initial height ; however, by working with relatively large initial heights, when A/h_o becomes small, the value of H_∞ becomes nearly constant. This is illustrated in Figure 4 (a) which shows the data of Figure 3 (a) calculated as a graph of H_∞ against h_∞. So long as h_∞ is greater than about 4 cm the value of H_∞ is not greatly dependent on h_∞ ; it is therefore recommended that when H_∞ is determined, h_∞ should be at least 4 cm which for normal juice corresponds to an initial height of about 40 cm.

Considering now the definition of R, we find by combining equations (4) and (6) that :

$$R = 100\, Dc_o \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

i.e. R is not constant for a given juice but varies linearly with the mud concentration. It is therefore desirable to replace R by a different empirical constant which is, as far as possible, constant under all possible conditions. This can be done as follows : when h_o is sufficiently large, an approximation to equation (5) is :

$$h_\infty = Bc_o h_o \quad \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Dividing equation (9) by equation (6) :

$$h_\infty/\sqrt{k} = B/D \quad \ldots\ldots\ldots\ldots\ldots (10)$$

i.e. the value of $h_\infty/\sqrt{k}$, is a constant under the conditions for which the approximation leading to equation (9) is valid. By combining equations (3) and (4) it is readily seen that :

$$h_\infty/\sqrt{k} = H_\infty/R \quad \ldots\ldots\ldots\ldots\ldots (11)$$

and it is convenient to describe this ratio by a new constant $\sqrt{K}$. From equation (2) it can be seen that :

$$\sqrt{\frac{K}{v}} = \frac{h_\infty}{h - h_\infty} \quad \ldots\ldots\ldots\ldots\ldots (12)$$

and K is numerically equal to the velocity of the mud interface at the point when the mud has twice its final volume, i.e., when $h = 2\, h_\infty$.

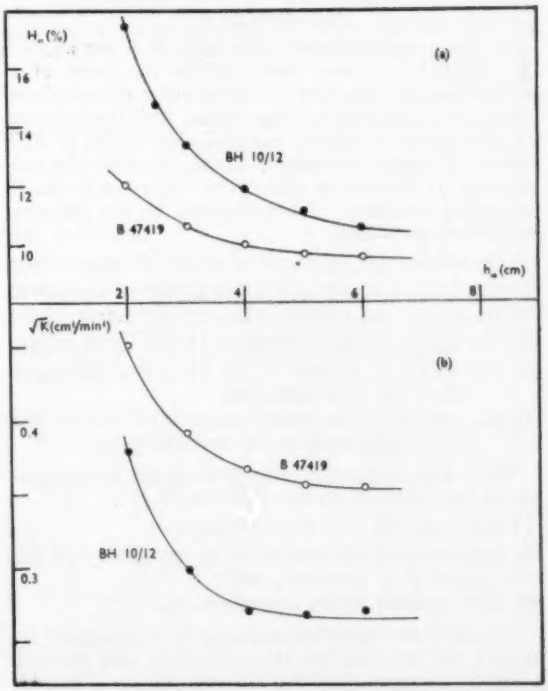

FIG. 4.—H_∞ and $\sqrt{K}$ vs. h_∞.

Graphs of K against h_∞, for the same results as those shown in Figure 3, are shown in Figure 4 (b) ;

it will be seen that, as expected, provided h_∞ is sufficiently large the value of K is reasonably constant for a given juice.

In the above, the significance of H_∞ and K (or R in the old system) has been discussed ; the question of t_0 must now be briefly mentioned. The above empirical approach shows that the final part of the settling curve is a hyperbola ; t_0 can then be taken as a measure of how quickly the settling curve attains the region where it has a hyperbolic shape, but as this appears to give no useful information about a juice, it is suggested that t_0 values should not be specifically determined. As a mathematical point, it may be noted that there is a whole family of settling curves corresponding to each straight line in an h vs. $\sqrt{v}$ diagram so that there will be a family of settling curves corresponding to particular values of K and H_∞ ; the point has been demonstrated experimentally. This is not necessarily a disadvantage to the use of K and H_∞ values since all such settling curves will have the same ultimate hyperbolic shape, which is taken as implying that the juices giving the family of settling curves have at least some fundamental physical characteristics in common.

ACKNOWLEDGEMENTS

This work forms parts of a programme of research carried out by the B.W.I. Sugar Research Scheme. The author would like to thank Mr. W. S. WISE and Dr. M. C. BENNETT for many helpful discussions, and Mr. A. F. THOMSON for considerable assistance in the design and construction of the apparatus.

CALCULATIONS IN MASSECUITE BOILING SYSTEMS

By F. GARCÍA LOPEZ and JOSÉ A. CLARK.*

INTRODUCTION

IN the manufacture of raw sugar it is sometimes difficult to foresee what will be the result of a minor modfication in the process or a radical change to a different boiling system. It is the purpose of this article to give a method—applicable to any system in operation—which makes possible the calculation of the rate at which the following products are being produced or are required by the process, as the case may be :

(1) the volume and weight of all grades of massecuites;
(2) the volume and weight of all grades of molasses;
(3) the weight and average grain size of the raw sugar;
(4) the weight of the crystallizer or low-grade sugar;
(5) the weight or volume of the hot water needed to dilute the molasses, and
(6) the weight of the water evaporated and of the steam consumed in the vacuum pans.

When two or more process systems are being compared, the method permits calculation of :

(7) their relative pan floor capacities ;
(8) their relative efficiencies as to the quality of the raws they produce; and
(9) their relative steam consumptions.

To carry out these calculations it is necessary to know : (a) the *true* purity coefficients and percent solids by desiccation of the different grades of massecuites, molasses and sugars made ; (b) the average grain size of the crystallizer sugar produced, and, (c) the weight of the solids—dissolved in the syrup—that enter the pan floor per unit time.

When the method is applied to a system in operation the above variables are taken from a representative laboratory report. In comparative studies, these figures should be estimated. If apparent purities and degrees Brix are taken in place of true purities and percent real solids, approximate results would be obtained.

The method comprises two series of operations : first, the calculation of what we call the "Flow Diagram" in which the quantities of all materials produced—the finished ones as well as those under process—are expressed, on a dry solids basis, as percentages of the weight of the solids that enter the pan station dissolved in the syrup and, second, the computation of the total weight—or volume—of each material that is produced per unit time if the rate of solids entrance is known. Fig. 1 is such a flow diagram for the Webre-Mayoral boiling system, while that for the old three-boiling system is given as Fig. 2, for comparative purposes. The former is the system for which calculations will be given in this paper.

Due to the complexity of some boiling and purging schemes, it is advisable to make a drawing of the particular system being studied in which the known process variables should be given. In these drawings, the percent dry solids of the materials are placed in brackets. The different grades of massecuites are marked with capital letters and the results of the calculations which represent the flow of materials are written—followed by the percentage sign—as soon as they are worked out.

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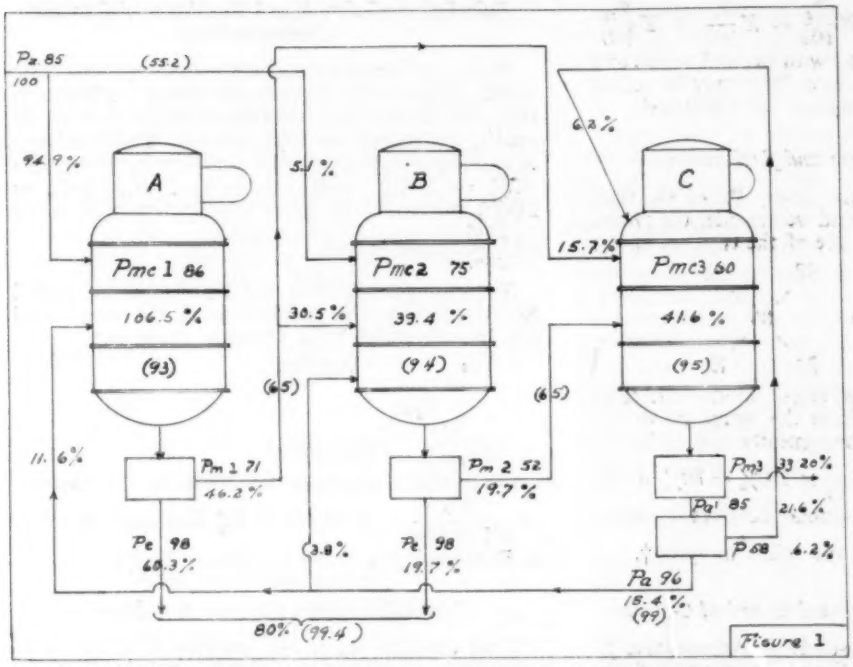

FIG. 1.—Webre-Mayoral system for raw sugar production. Grain is established in the C-s[illegible] only by graining *A*-molasses. After its stay in the crystallizer the *C*-massecuite is purged, [illegible]ar washed in the centrifugals and mingled with syrup to form the footings for the *A*- and *B*-strikes which yield commercial sugar.

The notation of the symbols used and value of the variables for the flow diagram shown in figure 1, are: P_z = purity of syrup = 85, P_{mc1} = purity of *A*-massecuite = 86; P_{m1} = purity of *A*-molasses = 71; P_{mc2} = purity of *B*-massecuite = 75; P_{m2} = purity of *B*-molasses = 52; P_{mc3} = purity of crystallizer massecuite = 60; P_{m3} = purity of final molasses = 33; $P_{a'}$ = purity of unwashed *C*-sugar = 85; P_a = purity of washed *C*-sugar = 96; P = purity of *C*-washings = 58; P_e = purity of the raws = 98; solids of syrup = 55·2%, solids of diluted molasses = 65%, solids of the raws = 99·4%, solids of washed *C*-sugars = 99%, solids of *A*-massecuite = 93%; solids of *B*-massecuite = 94%; solids of *C*-massecuite = 95%; average grain size of *C*-sugar = 0·5 mm.

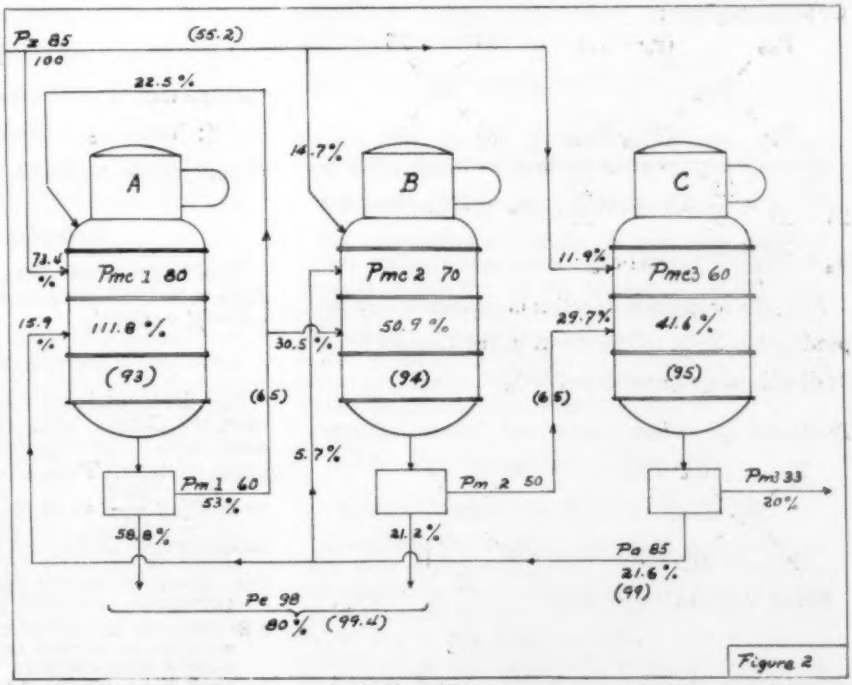

FIG. 2.—Old three-boiling system. Grain is established in the *C*-strike only by graining syrup. *C*-sugar is not washed in this scheme, but the remaining steps are similar to those of the system shown in Fig 1.

The *C*-massecuite, also known as the final or crystallizer strike, produces final molasses and crystallizer or *C*-sugar. Usually the latter, mingled with syrup, is used as footing for the commercial, *A* and *B*, massecuites.

FLOW DIAGRAM CALCULATIONS.

Considering the entire boiling house as a unit which receives 100 weight units of solids (dissolved in syrup) of purity P_z and which yields X weight units of solids—in the raw sugar—of purity P_e, and also, Y weight units of solids—in the final molasses—of purity P_m, two equations can be written: one expressing the weight equality between the solids entering and leaving the system and another one showing sucrose equality on the same basis.

Thus: $100 = X + Y$, and $100\frac{P_z}{100} = X\frac{P_e}{100} + Y\frac{P_m}{100}$

These two linear equations with two unknowns and the many others that will occur later may be solved by applying Cobenze's diagram for mixtures[1].

Production of raw sugar and final molasses

Where the purity of the raws, P_e, = 98, final molasses purity $P_{ms} = 33$, and we consider the syrup, of purity $P_z = 85$, as a mixture of the two; we have :

$$\begin{array}{ccccc} P_e & (P_z\text{-}P_{ms}) & & 98 & 52 \\ & \searrow \quad \swarrow & & \searrow \quad \swarrow & \\ & P_z & = & 85 & \\ & \swarrow \quad \searrow & & \swarrow \quad \searrow & \\ P_{ms} & & (P_e\text{-}P_z) & 33 & 13 \end{array}$$

hence, the weights of raw sugar solids and final molasses solids produced from the syrup are in the proportion of 52 : 13. Consequently the solids in raw sugar represents $\frac{52}{52+13} \times 100\% = 80\%$ of the solids in syrup, while solids in final molasses represent $\frac{13}{52+13} \times 100\% = 20\%$ of the solids in syrup†.

Production of C-massecuite and unwashed C-sugar

Let w_s be the weight of solids in *C*-massecuite % weight of solids in syrup. Since the purging of the *C*-strike (purity P_{mcs}) yields the final molasses (purity P_{ms}) and the unwashed *C*-sugar (purity $P_{a'}$), the proportions can be calculated with another Cobenze diagram :

$$\begin{array}{ccccc} P_{ms} & (P_{a'}\text{–}P_{mcs}) & & 33 & 25 \\ & \searrow \quad \swarrow & & \searrow \quad \swarrow & \\ & P_{mcs} & = & 60 & \\ & \swarrow \quad \searrow & & \swarrow \quad \searrow & \\ P_{a'} & & (P_{mcs}\text{–}P_{ms}) & 85 & 27 \end{array}$$

Hence the proportion of final molasses solids is $\frac{25}{25+27} = \frac{25}{52}$. Therefore $\frac{25}{52} \times w_s = 20\%$. From this $w_s = \frac{20 \times 52}{25}\% = 41{\cdot}6\%$.

Also, the proportion of solids in unwashed *C*-sugar produced is 27/52 of the solids in the *C*-strike $= \frac{27}{52} \times 41{\cdot}6\%$ on syrup solids $= 21{\cdot}6\%$.

Production of washed C-sugar and C-sugar washings

$$\begin{array}{ccccc} P_a & (P_{a'}\text{–}P) & & 96 & 27 \\ & \searrow \quad \swarrow & & \searrow \quad \swarrow & \\ & P_{a'} & = & 85 & \\ & \swarrow \quad \searrow & & \swarrow \quad \searrow & \\ P & & (P_a\text{–}P_{a'}) & 58 & 11 \end{array}$$

Hence washed *C*-sugar solids $= \frac{27}{27+11} \times 21{\cdot}6\%$
$= 15{\cdot}4\%$

while solids in *C*-washings $\% = \frac{11}{38} \times 21{\cdot}6\% = 6{\cdot}2\%$.

Calculation of the A and B-molasses fed to the C-massecuite

Since the *C*-massecuite solids = 41·6% on syrup solids, of purity 60, the sucrose content is 25·0%. Of this, the *C*-washings contribute 6·2% solids of 58 purity, equivalent to 3·6% sucrose. The combined *A* and *B*-molasses feed must therefore total 41·6%—6·2% = 35·4% solids, containing 25·0%—3·6% = 21·4% sucrose. This gives a combined feed purity of $\frac{21{\cdot}4}{35{\cdot}4} \times 100 = 60{\cdot}4$.

Since the purities of *A* and *B*-molasses are 71 and 52, respectively, the proportions in the mixed feed can be calculated by a Cobenze diagram :

$$\begin{array}{ccccc} P_{m_1} & (P_{feed}\text{–}P_{m_2}) & & 71 & 8{\cdot}4 \\ & \searrow \quad \swarrow & & \searrow \quad \swarrow & \\ & P_{feed} & = & 60{\cdot}4 & \\ & \swarrow \quad \searrow & & \swarrow \quad \searrow & \\ P_{m_2} & & (P_{m_1}\text{–}P_{feed}) & 52 & 10{\cdot}6 \end{array}$$

Hence the *A*-molasses solids fed to the *C*-strike $= \frac{8{\cdot}4}{8{\cdot}4+10{\cdot}6} \times 35{\cdot}4\% = 15{\cdot}7\%$. Similarly the solids in *B*-molasses fed to the *C*-strike = 19·7%

Production of B-sugar and B-molasses

If we consider w_s as the quantity of solids in *B*-massecuite of 75 purity, yielding 19·7% of solids in *B*-molasses, and *B*-sugar of 98 purity, then from the Cobenze diagram

$$\begin{array}{ccccc} & & & 52 & 23 \\ & & & \searrow \quad \swarrow & \\ & & = & 75 & \\ & & & \swarrow \quad \searrow & \\ & & & 98 & 23 \end{array}$$

the amount of *B*-molasses solids $= \frac{23}{23+23} w_s = 19{\cdot}7\%$; hence $w_s = 39{\cdot}4\%$. Also, the amount of *B*-sugar solids produced $= \frac{23}{46} \times 39{\cdot}4\% = 19{\cdot}7\%$.

Production of A-sugar

Total sugar production is 80%, and *B*-sugar production is 19·7%; hence *A*-sugar production is 80% —19·7% = 60·3%.

C-sugar distribution

In order to attain the same average grain size in the raws, the *C*-sugar solids should go to the *A* and *B*-massecuites in direct proportion to these massecuites' yields of sugar. Thus, *C*-sugar for the *A*-massecuite $= 15{\cdot}4\% \times \frac{60{\cdot}3}{80} = 11{\cdot}6\%$, and *C*-sugar for the *B*-massecuite = 15·4% — 11·6% = 3·8%.

[1] See SPENCER & MEADE : *Cane Sugar Handbook* 8th Edn. (Wiley, New York) 1945. p. 639.

† Hereafter, for the sake of brevity and because all results are given on the same basis, the sign % following the material being calculated will mean the weight of the solids in the material in question percent the weight of the solids in the syrup.

Calculation of the syrup and A-molasses fed to the B-massecuite

The B-strike solids (39·4%) of 75 purity contain 29·6% sucrose; of this the C-sugar content represents 3·8% solids of 96 purity, thus including 3·6% sucrose. Consequently the mixed feed to the B-strike contains 39·4% — 3·8% = 35·6% solids containing 29·6% — 3·6% = 26·0% sucrose ; this gives a purity of $\frac{26}{35{\cdot}6} \times 100 = 73$. By applying Cobenze's diagram, the proportions of syrup (purity 85) and *A*-molasses (purity 71) are calculated as follows :

The syrup solids fed to the strike $= \frac{2}{2+12} \times 35{\cdot}6\% = 5{\cdot}1\%$ while the *A*-molasses solids fed to the strike $= \frac{12}{2+12} \times 35{\cdot}6\% = 30{\cdot}5\%$.

Syrup fed to the A-strike

Total syrup solids = 100, so the syrup fed to the *A*-strike = 100–5·1% = 94·9%

Total production of A-molasses is 15·7% + 30·5% = 46·2% and the *production of A-massecuite* = 11·6% + 94·9%

Verification of A-massecuite purity

The syrup (94·9%) in *A*-massecuite, of 85 purity, contains $\frac{85 \times 94{\cdot}9}{100}\% = 80{\cdot}6\%$ sucrose. The *C*-sugar present (11·6%), of 96 purity, contains $\frac{11{\cdot}6 \times 96}{100}\%$ = 11·1% sucrose. Consequently the *A*-massecuite (of 106·5% solids) contains 91·7% sucrose and is of $\frac{91{\cdot}7}{106{\cdot}5} \times 100$ purity = 86 purity.

VACUUM PAN CAPACITY

In comparative studies it can approximately be accepted that pan capacities are inversely proportional to the total weight of solids processed in massecuites % by weight of solids in the syrup. For the two systems illstrated by the diagrams shown in Figs. 1 and 2, these weights are, respectively,

Webre-Mayoral (Fig. 1) = 106·5 + 39·4 + 41·6 = 187·5%, and Old 3-Boiling System (Fig. 2) = 111·8 + 50·9 + 41·6 = 204·3%. This means, for instance, that if the pan station of a certain factory working according to the process shown in Fig. 2 limits the grinding to 3,000 tons of cane daily, a change over to the process depicted in Fig. 1 would allow a grinding of :

$$\frac{3000 \times 204{\cdot}3}{187{\cdot}5} = 3{,}260 \text{ tons per day}$$

The pan station will absorb the increase. It would be taken for granted that the extraction, Brix and purity of normal juice remain unchanged.

RAW SUGAR QUALITY INDEXES

Apart from the nature of the juice and the importance of its good clarification, and irrespective of the significance that the use of the most efficient equipment and techniques in the process operations bear upon the quality of the raws, it may be said that each particular boiling system has, *per se*, a definite bearing on the refining charactersitics of the sugar it produces. The Raw Sugar Quality Index takes into consideration the percent production of each grade of sugar being manufactured and the purity of the layers of molasses surrounding the grains. The higher the Index the easier the refining. It is found, surprisingly, that systems involving molasses graining are likely to have higher Indexes.

Raw Quality Index for the system illustrated in Fig. 1,

$$= \frac{60{\cdot}3\ (71) + 19{\cdot}7\ (52)}{60{\cdot}3 + 19{\cdot}7} = 66{\cdot}3$$

Raw Quality Index for the system of Fig 2.

$$= \frac{58{\cdot}8\ (60) + 21{\cdot}2\ (50)}{58{\cdot}8 + 21{\cdot}2} = 57{\cdot}3$$

AVERAGE GRAIN SIZE OF RAW SUGAR

When the average grain size of the *C*-sugar is known and the entire production of this sugar is used as footings to make the A and B (commercial) massecuites, the average grain size of the raws may be estimated as follows :

$$\text{Sugar size, (Fig. 1 system)} = 0{\cdot}5 \sqrt[3]{\frac{80\ (98)}{15{\cdot}4\ (96)}}$$
$$= 0{\cdot}87 \text{ mm},$$

0·5 mm being the average size of the *C*-sugar. Deviations from the calculated size occur frequently.

EVAPORATION AND DILUTION FORMULAE

For a product of weight W and Brix Bx, the weight of its solids would be = W Bx/100, hence, W/solids = 100/Bx. If the product is diluted with water and its weight becomes W′ and its new Brix Bx′, the weight of its solids would be = W′ Bx′/100, hence, W′/solids = 100/Bx′. The weight of the added water would be = W′—W and the weight of the added water per unit of solids would be equal to :

$$\frac{W'-W}{\text{Solids}} = \frac{W'}{\text{solids}} - \frac{W}{\text{solids}} = \frac{100}{Bx'} - \frac{100}{Bx}$$

CALCULATION OF THE RATE OF PRODUCTION

It would be too lengthy to give detailed calculations of the flow of all products but in a table accompanying this article the results of such calculations are given. As an example, the flow of feed molasses, both A and B, per day, at 65% solids and 20°C, for a mill which follows the process of Figure 1 and for a grinding producing 800,000 pounds of solids in syrup daily, is calculated.

From the flow diagram of Fig. 1, the weights of solids in A and B molasses % the weight of solids in syrup, are added :

$$46{\cdot}2 + 19{\cdot}7 = 65{\cdot}9$$

Dry solids in intermediate molasses produced per day :

$$\frac{800{,}000\ (65{\cdot}9)}{100} = 527{,}200 \text{ pounds}$$

Since the solids dissolved in a gallon of a sucrose solution at 65° Brix and 20°C weigh 7·14 pounds[2] the daily production of diluted molasses at this Brix will be :

$$527{,}200/7{\cdot}14 = 73{,}800 \text{ gallons}$$

To calculate the rate of production of raw sugar, from Fig. 1, its representative figure is picked out and the following operations made :

Dried sugar production per day = 800,000 (0·8) = 640,000 pounds

Production of sugar with 0·6% moisture content

$$\frac{640{,}000(100)}{100\text{–}0{\cdot}6} = 643{,}863 \text{ pounds}$$

Calculation of Evaporation

The water evaporated by the vacuum pans comes from the materials from which the massecuites are made, viz. the syrup, the molasses and the *C*-sugar. Since the Brix density of these products are known as well as the Brix density to which they are evaporated—those of the massecuites—the problem is solved by applying the formula for evaporation previously deduced.

For a daily input of 800,000 pounds of solids in the syrup and for a mill working in accordance with the flow diagram of Fig. 1, the total evaporation by the pans will amount to 836,100 pounds daily as shown by the following operations :

Average Brix of massecuites =

$$\frac{106{\cdot}5(93) + 39{\cdot}4(94) + 41{\cdot}6(95)}{106{\cdot}5 + 39{\cdot}4 + 41{\cdot}6} = 93{\cdot}65$$

Evaporation from the syrup =

$$800{,}000\left(\frac{100}{55{\cdot}2} - \frac{100}{93{\cdot}65}\right) = 595{,}200 \text{ pounds}$$

Solids in *A* and *B* molasses % solids in syrup = 46·2 + 19·7 = 65·9

Evaporation from the *A* and *B* molasses :

$$800{,}000\ (0{\cdot}659)\left(\frac{100}{65} - \frac{100}{93{\cdot}65}\right) = 248{,}000 \text{ pounds}$$

Evaporation from the *C*-sugar :

$$800{,}000\ (0{\cdot}154)\left(\frac{100}{99} - \frac{100}{93{\cdot}65}\right) = -7{,}100 \text{ pounds}$$

Total water evaporated per day :

595,200 + 248,000 + (–7,100) = 836,100 pounds.

Calculation of Steam Consumption

Assuming that 1·15 pounds of steam is needed for the evaporation of one pound of water, the steam required to perform the evaporation in the process operations illustrated in Fig. 1 will be :

836,100 (1·15) = 961,500 pounds daily, or :

961,500 / 24 = 40,060 pounds per hour.

Calculation of Water for Molasses Dilution

To make this simpler, a fixed Brix of 84° is assigned to the intermediate molasses as it leaves the centrifugal machines. Subsequently the molasses is diluted to 65°Brix. By applying the dilution formula, the water needed to dilute the molasses is calculated as follows :

$$800{,}000\ (0{\cdot}659)\left(\frac{100}{65} - \frac{100}{84}\right) = 184{,}520 \text{ pounds/day}$$

Or : 184,520/8·1 (24) = 950 gallons/hour.

Appendix.

Material flow rates for 800,000 *pounds of solids arriving at the pan station daily.* (The term massecuite and solids are respectively abbreviated MC and Sol.)

	Webre-Mayoral System	*Old Three Boiling System*
	Fig. 1	*Fig.* 2
Sol in A–MC % Sol in syrup	106·5	111·8
Sol in B–MC % Sol in syrup	39·4	50·9
Sol in C–MC % Sol in syrup	41.6	41·6
Total Sol in MC % Sol in syrup	187·5	204·3
Sol in A-molasses % Sol in syrup	46·2	53
Sol in B-molasses % Sol in syrup	19·7	29·7
Total Sol in feed molasses % in syrup	65·9	82·7
Sol in final molasses % Sol in syrup	20	20
Cubic feet A–MC, 93° Bx daily	9,780	10,300
Cubic feet B–MC, 94° Bx daily	3,560	4,600
Cubic feet C–MC, 95° Bx daily	3,710	3,710
Total cubic feet in MC	17,050	18,610
Gallons A-molasses, 65° Bx, daily	51,700	59,400
Gallons B-molasses, 65° Bx, daily	22,100	33,300
Total gallons feed molasses	73,800	92,700
Gallons final molasses, 88° Bx, daily	14,900	14,900
Lb C-sugar, 99° Bx, daily	124,440	174,500
Commercial Sugars.		
Lb A-sugar, daily	485,311	473,239
Lb B-sugar daily	158,552	170,624
Total production, lb daily	643,863	643,863
Average size mm	87	81
Water.		
Total evaporated, lb daily	836,100*	893,400*
Needed for molasses dilution, Gal/hr	950	1190
Steam.		
Needed for evaporation, lb/hr	40,060*	42,800*
Boiler HP equivalent	1,160*	1,240*
Comparative values.		
Raw sugar quality index	66	57
Pan capacity	109	100
Steam consumption	100	107

* Considerably lower figures are obtained when a syrup of much higher density is processed.

U.S. Beet Sugar Crop, 1958[3].—The production of sugar beets in 1958 was the second highest on record at 15,183,000 tons and only 2·1% below the record 1957 crop of 15,505,000 tons. The average yield was 17·1 tons per acre, several states setting new record yields, the most notable of which was over 27 tons per acre in Oregon. Production of refined sugar from the 1958 crop totalled 2,058,000 tons.

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Sugar Factory for Thailand[4].—A group of Chinese living in Thailand have bought a shut-down sugar factory from the Taiwan Sugar Corporation and propose to import it into Thailand for production of centrifugal sugar.

[2] *Ibid.* Table 30, page 734.
[3] *Lamborn*, 1959, **37**, 130.
[4] F. O. Licht, *International Sugar Report*, 1959, **91**, (Supp. 12), 167.

Micro-Organism Control in Cuban Sugar Mills. J. W. APPLING and I. WARNER. *Sugar J.* (La.), 1959, **22,** (8), 19–27.—Reference is made to the use of "Busan 81" by spraying over cane entering mills and addition to juice in order to reduce bacterial losses.[1]

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Experimental Programme on Sugar Processing. M. SUÁREZ CARREÑO. *Sugar J.* (La.), 1959, **22,** (8), 39.—An experimental 3-roller mill and sugar production equipment at Villanueva University are briefly described, and a summary given of recent investigations carried out.

* * *

Prevention of Sugar Deterioration During Storage. R. S. DUBEY. *Indian Sugar*, 1958, **8,** 491–492, 511–521.—Factors causing deterioration in stored sugar are reviewed with 31 references to the literature, and a series of eleven recommendations made to give optimum process conditions. Construction of new godowns and modification of existing godowns are discussed, with recommendations for their improvement in respect of moisture-proofing, ventilation and ease of sugar transfer.

* * *

Replacement of Frame and Plate Type Filter Presses by Rotary Drum Type Vacuum Filter in Sulphitation Sugar Factories. K. P. MITTAL. *Indian Sugar*, 1958, **8,** 495–497.—The two types of filter are compared and it is concluded that it is economical to replace presses by a vacuum filter.

* * *

Sugar Industries of China. R. J. LEFFINGWELL. *Sugar y Azúcar*, 1959, **54,** (1), 23–24.—The Taiwan sugar industry is described with brief reference to the sugar industry of Mainland China.

* * *

New Method Increases Recovery in India. J. M. SAHA, D. L. N. RAO and V. SINGH. *Sugar y Azúcar*, 1959, **54,** (1), 26–27 —See *I.S.J.*, 1959, **61,** 176.

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Defecation *versus* Sulphitation. K. DOUWES DEKKER. *S. African Sugar J.*, 1959, **43,** 43–51.—The cost of chemicals used in defecation is much less than in sulphitation, while evaporator scaling is also reduced. No apparent difference is found in recovery, and final molasses purity is not affected, while it is not likely that the weight of molasses produced by the two processes do not differ appreciably. No significant difference is found in the starch, gums or filtrability of the raw sugar produced although the colour of defecation sugar is higher.

Capacities of Water and Air Pumps. C. G. M. PERK. *S. African Sugar J.*, 1959, **43,** 51–59.—The cooling water required and air to be removed in the case of pans and evaporators are discussed, and examples of their calculation worked out in the case of A–, B–, C– and refined sugar pans and for quadruple and quintuple effects.

* * *

The Problem of Increased Milling Costs. A. B. CHIRGWIN. *Sugar J.* (La), 1959, **22,** (9), 27–28.—The reduction of unit costs by increasing milling capacity is briefly discussed. The necessity of eliminating bottlenecks by supplementing or replacing existing plant is mentioned. Ways of increasing tandem capacity suggested include installation of a second set of knives, which allows reduced roll pressure and so permits the same engine to handle increased grinding rates; removal of tramp iron by a magnetized pulley which supports a section of high-speed belt conveyor on which the blanket is much thinner than usual; use of rubber belts instead of chain-and-slat conveyors; fitting air-clutches to the intermediate carriers; modification of gears and use of steam turbine drive if necessary. Good repair of the mills and free movement of top rolls is, of course, essential.

* * *

Good Maintenance with Lubrication. J. H. FULLER. *Sugar J.* (La), 1959, **22,** (9), 29–31.—A review.

* * *

Utilization of an Ion Exchange Process in Sugar Refining. I. Decolorizing Effects by using the Chloride Cycle of a Strongly Basic Anion Exchange Resin. II. Clarifying Effects from the use of Sulphonate and Phosphonate Cycle Strongly Basic Anion Exchange Resins. S. IWASHINA. *J. Agric. Chem. Soc. Japan*, 1957, **31,** 293–296; 827–830; through *Chem. Abstr.*, 1958, **52,** 19194.

(I) Sugar solutions of approx. 60–64°Bx were decolorized and deionized with a strongly basic anion exchanger operating on the chloride cycle. The decolorization efficiency was assessed on 290 samples of different colour and ash contents. In contrast to decolorization with active carbon, colour leak, measured in °Stammer, tended to be constant even with highly coloured liquors purified by carbonatation and bone char treatment. The colour leak increased with increasing ash content in liquors purified with active carbon, but ash had only a slight effect in liquors purified by carbonatation. Demineralization and salt conversion occurring in the carbonatation process are considered to have a favourable effect on the efficiency of resin treatment. Inversion

[1] Cf. *I.S.J.*, 1959, **61,** 86.

occurs to some extent during resin treatment as a result of the lowering of the pH.

(II) Decolorization of sugar liquors with the chloride form of a resin results in the liberation of chloride ions into solution, so that low-grade sugars have a bitter taste and are hygroscopic owing to the presence of KCl and $CaCl_2$. The use of sulphate or phosphate ion exchange resins for the removal of KCl and $CaCl_2$ is limited since the Ca is precipitated as $CaSO_4$, $Ca_3(PO_4)_2$ or $CaHPO_4$ on the resin, thereby inhibiting the exchange of ions. Practical application of this method may be limited to solutions of Ca less than 1 g (expressed as NaCl/litre). The decolorizing power of the sulphate or phosphate forms of the resin is much less than that of the chloride form. The phosphate form is inconvenient to use since the amount of resin regenerated is low and the inhibitory effect of the precipitated Ca is greater than with the sulphate form of the resin.

* * *

Calculation of the Weight of Final Molasses. G. LAMOGLIA Y FRAU. *Bol. Ofic. A.T.A.C.*, 1958, **17**, 775–778.—Molasses may either be weighed by scales or calculated using a "Pneumercator" gauge or from the tank dimensions. The gauge method is considered to be satisfactory, and a calculation of the likely error with this instrument and with volume calculation shows it to be more accurate.

* * *

Rapid Cooling of High Purity Strikes. C. A. FORN. *Bol. Ofic. A.T.A.C.*, 1958, **17**, 791–795.—The literature on rapid cooling of *A* and *B*-strikes is discussed. Experience at Central Violeta has shown that a *B*-strike of average purity 76·8 at 67°C, with a temperature drop of 11°C will give a molasses of 51·3 purity; hence it is believed that a three-boiling system, eliminating molasses recirculation, is the best process to use.

* * *

Automatic Palletization Facilities at Crockett. ANON. *Sugar y Azúcar*, 1959, **54**, (2), 26–28.—A new $1·6m installation at Crockett refinery, California, conveys packaged sugar from refinery to warehouse, mechanically sorts various size bags and cases, automatically loads pallets and despatches them to any one of four different destinations for storage or shipment.

* * *

Checking Corrosion in Evaporator Tubes. U. VILLAR LORENZO. *Sugar y Azúcar*, 1959, **54**, (2), 30–31.—Reasons for diagnosis of tube corrosion as being due to inadequate removal of incondensible gases—particularly ammonia—are discussed and remedies listed. These are all to provide better venting of the gases and have proved successful.

* * *

Invert Sugar Balance in a Double Carbonatation Factory. S. P. SANYAL. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 35–38.—An invert sugar balance is drawn up, based on analyses of mixed juice, clear juice, un-sulphured syrup and molasses. Pol and Brix balances were also drawn up to ensure accuracy of quantity calculations. It is seen that maximum invert destruction occurs during clarification, and slight destruction during evaporation. Destruction during boiling is erratic, possibly as a result of overheating in pans or pan supply tanks.

* * *

Synergism in Antifoaming Agents. N. A. RAMAIAH and S. K. D. AGARWAL. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 71–74.—Efficiency of certain mixtures of anti-foaming agents is greater than the expected combined effect of the constituents and it is found that a mixture of turkey red oil and "cerfak" in certain unstated proportions gives a maximum efficiency. (See also *I.S.J.*, 1959, **61**, 284.)

* * *

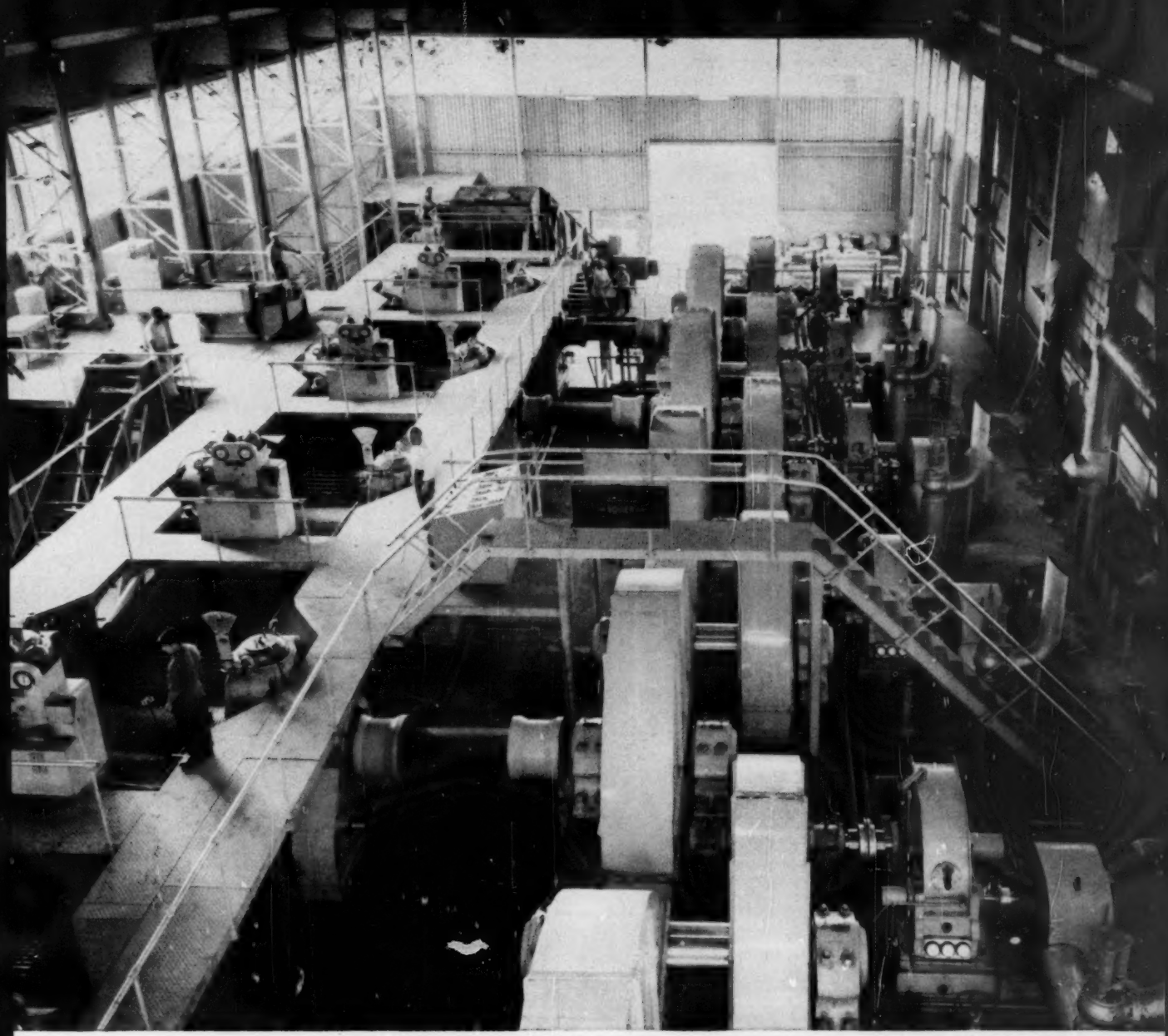
Care of Electrical Power Equipment in Sugar Factories. G. R. ATHAVALE and S. L. SAXENA. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 115–124.—Supervision and maintenance of the generators, distribution system, electric motors, starters and protective devices and lighting and heating equipment are reviewed.

* * *

Use of Superphosphate in Cane Juice Clarification and Determination of CaO in Sugar House Products. I. J. M. SAHA, D. L. N. RAO and V. SINGH. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 125–134.—Agitation of superphosphate with water at 60°C was found to give a higher P_2O_5 content than boiling. Clarification was not affected by adding the superphosphate as a solution rather than as a slurry and the latter method thus saves some expenditure and labour for filtration or settling, as well as phosphate losses in the insolubles. Calcium analysis by titration with soap solution and by formation of oxalate both directly and after ashing and dissolving in HCl are compared; the soap solution method (which is found to account for calcium sulphate in solution, contrary to beliefs expressed to the author) gives lower values than the oxalate method "via ash", and this gives lower values than the "direct" oxalate method, which is preferred. Phosphate in triple superphosphate is best determined by the ammonium molybdate method while for single superphosphate the uranium acetate method is simpler and almost as accurate.

* * *

pH Control at the 2nd Carbonatation Station of a Double Carbonatation Factory. S. P. SANYAL. *Proc. 26th Conv. Sugar Tech. Assoc. India.* 1958, 135–136.—During factory trials, second carbonatation juice was gassed to various pH values (judged with thymol blue) and the alkalinity, as mg CaO per litre, measured by titration with N/28 sulphuric acid and hardness, also as mg CaO per litre, measured by titration with EDTA. Optimum pH for minimum hardness varied from 8·7 to 8·9 during the season. For a particular pH the alkalinity was higher as the cane matured, probably due to difference in buffering constituents. Minimum hardness also rises as cane matures; possible reasons are numerous and require extensive study.



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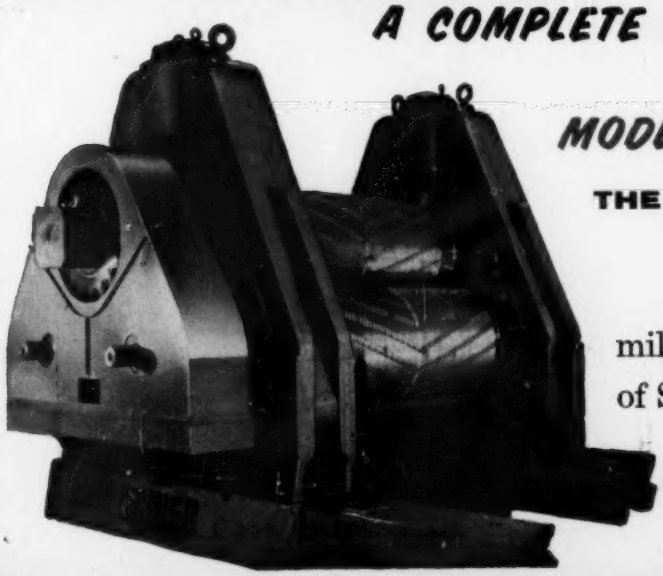

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New Formula for Reduced Mill Extraction. B. L. MITTAL. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 137–140.—The objections to the Deerr reduced mill extraction formula are reviewed and drawbacks to using Brix extractions are discussed. A new formula is calculated from pol values, viz :

$$e' = 1 - \frac{(0{\cdot}125)}{f}(P_{bc}/P_c)$$

where e′ is the reduced mill extraction; f is fibre per unit cane, P_{bc} is pol in bagasse % cane; and P_c is pol in cane. A table of extractions is drawn up for the new formula and Deerr's formula, illustrating the variation with fibre content, assuming that fibre and pol per unit bagasse and pol per unit cane remain the same.

* * *

Observations on some Aspects of Sugar Manufacture. S. L. PHANSALKAR and H. C. BHATTACHARYA. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 155–159.—The variation of unknown loss in various Indian factories over the range 0·03 to 0·058% indicates a lack of standardization. From a study of statistics for a number of factories and years, it is seen that for a particular factory, the ratio of sugar bagged (stock) to sugar in cane (input) is of the same order, and may be brought within closer limits; this ratio influences molasses and/or unknown loss and may have a critical value corresponding to minimal loss. Use may be made of the ratio in factory control. Massecuite quantity and steam consumption are considered for four boiling schemes and the increases calculated for those designed to produce grain of C-size rather than E-size.

* * *

Weighment of Bagasse. S. L. PHANSALKAR and H. C. BHATTACHARYA. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 161–163.—An apparatus for weighing bagasse is described. Bagasse drops from a conveyor into a hopper with a counter-weighted flap-valve. From this it is delivered to a basket suspended from a weighbridge. When the basket contents reach a predetermined weight, the beam moves, operating a micro-switch which causes the basket flap-valve to be opened electrically. At the same time the bagasse conveyor is stopped and a counter records the batch. When the basket is empty the valve closes and the conveyor starts again. The bagasse discharges from the basket to a second hopper and thence to a second conveyor.

* * *

Studies on the Deterioration of Sugar during Storage in Godowns. IV. A Plea for the use of Ventilators in Warehouses. S. L. PHANSALKAR, N. A. RAMAIAH, K. P. ROY and L. SANYAL. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 169–173.—The relation of relative humidity to deterioration of sugar is briefly discussed and it is recommended that ventilators of a type described should be incorporated in warehouses. The ventilators are of a double-panel type, fitted with seals, and lever operated, with the possibility of automatic operation.

Sugar Cane Grinding Mill Openings. U. C. UPADIYA *Indian Sugar*, 1958, **8**, 555–556.—Mill openings (y) are calculated from the expression $y = \frac{W}{60\pi DNLd}$, where W = weight of bagasse per hr, D = corrected roll diameter, N = speed of the roller in r.p.m., L = roll length and d = bagasse density. The calculations are based on theoretical desirable sugar extractions of 83% at the crusher, 7·11% at the first mill, 3·75% at the second, 1·5% at the 3rd and 2·08% at the 4th mill, i.e. a total of 97·44%. Dry fibre density is assumed to be 1·6 and dry substance as 1·55 g/c.c. If the hydraulic load is maintained at 30% on the first squeeze and 70% on the second, mill juice analysis will indicate if and when readjustment is necessary.

* * *

Comparative Study of Man-Day Requirements in Various Sugar Industries of the World with Taiwan. J. C. CHOU. *Taiwan Sugar*, 1958, **5**, (12), 12–21.—A comparison is made between field and factory labour requirements in Lungyen factory over the past five years and those of Hawaii, Louisiana and Puerto Rico. Details are given of man-hour requirements and the economics of mechanization, etc., discussed for an area where labour is plentiful and cheap.

* * *

Pioneering in Supanburi. J. C. P. CHEN. *Taiwan Sugar*, 1958, **5**, (12), 22–31.—A detailed account is given of the new factory at Supanburi, Thailand, and covers cane growing, processing machinery, etc., and the first crop.

* * *

TJB.40C Centrifugals. J. ROCHA DE ALMEIDA. *Brasil Açuc.*, 1958, **26**, 319–323.—A description is given of the type TJB.40C centrifugal of Metalúrgica de Accessórios para Usinas S.A. of Piracicaba, as installed at Usina Porecatu in Paraná, Brazil. It is driven by a 40 h.p. Mausa electric motor of 1000–1200 r.p.m., and operating on 50/60 cycle current. The 27 × 42 inch basket has a conical bottom and loading may be manual or automatic, as may the complete cycle.

* * *

Bulk Discharging of Raw Sugar, using the Ship's Tackle. A. M. BARTOLO. *Paper presented to the 18th Annual Meeting, Sugar Industry Technicians Inc.*, 1959.—Cf. *I.S.J.*, 1958, **60**, 292.

* * *

Bulk Raw Sugar Handling System at St. Lawrence Sugar Refineries Ltd. G. CONSTABLE. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—A description is given of the layout and design of the system of handling raw sugar at St. Lawrence Sugar Refineries and also its operation, capacities, and some of the savings that have resulted. In general the system consists of a series of conveyors between dock side and the storage shed. On the other hand, since the storage shed was converted from the old bag storage, a rather different approach to distri-

bution has had to be used. Design and operational features of the unloading towers are described, perhaps the most interesting part of which is the portable operator's station. Methods of recovery to melt are also discussed.

* * *

Phosphoric Acid Defecation in Pressure Filtration at the Crockett Refinery. L. A. ZEMANEK. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—Phosphoric acid defecation has been employed at the C. & H. refinery in some form for many years. Its use in washed raw sugar liquor prior to Sweetland pressure filtration has been a standard operating procedure for almost ten years and has become a substantial and necessary supplement to char decolorization. The results obtained from this defecation process from both routine plant data and special plant tests are presented. Methods and equipment used in continuous treatment of feed liquor are discussed, together with description of a feed pipe mixer developed to overcome some of the problems encountered in continuous treatment. Also discussed is progress made in attempting to increase filtration efficiency of regenerated diatomaceous earth and thereby permit the use of higher rates of defecation.

* * *

Boiler Feed Water Problems in the Sugar Refining Industry. J. B. ELDRIDGE. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—To determine the reason for the serious build-up of sludge and scale which plugged the downcomer tubes of three main steam generators at Atlantic Sugar Refineries, a comprehensive series of tests of the raw water and condensate used to supply these units was carried out from June to September 1958. Based upon an analysis of the scale, the feed water consultants Hagan Corporation (Canada) Ltd., stated that it was primarily due to organic materials in the feed water. As the raw water obtained from the watershed supplying domestic water to the City of St. John and surrounding communities had always been acceptable, without treatment, in the past due to the low pressure at which steam is generated (150 p.s.i.g.), this supply was not under suspicion. Tests proved no change had occurred in this water which would account for the troubles experienced. The condensate used to make up the feed water is obtained from the vacuum pans and, of course, is not always free of sugar contamination. However, experience in this respect had been fairly good so it was believed that sugar was not the sole source of the organic contamination. Further tests revealed the continuous presence of oil in the condensate and investigations showed that this contaminant entered the steam through the various steam engines driving pumps throughout the refinery. These engines exhaust at 15 p.s.i.g. and this L.P. steam is used in the calandria vacuum pan. Atlantic are presently repiping the exhaust from these units so that it will be diverted to that part of the system the condensate of which enters the hot water system.

A Review of Present-Day Treatment of Low-Grade Massecuite. F. M. CHAPMAN. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—See *I.S.J.*, 1958, **60**, 367.

* * *

Development and Operation of a Ring-Type Calandria Pan. C. ESPY. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—When it became necessary to install new vacuum pans at Savannah refinery, Georgia, various types of pan were investigated. Among these was the ring calandria pan which was developed in Europe. This type of pan appeared to offer certain advantages. Two of these pans were installed for boiling remelt sugars and have been in service for several years. In 1958 the installation of a third ring calandria pan was completed at Savannah for use in boiling white sugar. The design and construction of the pan is given and the performance characteristics and results obtained from the use of this type of pan for boiling white sugar are discussed.

* * *

Incrustation and Cleaning of Heat Transfer Elements in the Sugar Industry (Heaters and Evaporators). P. HONIG. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—The cleaning of evaporators, heating surfaces in clarifiers, vacuum pans and crystallizers is discussed and illustrated with a number of examples of how these cleaning operations are performed. The concept is developed of cleaning operations as also covering revivification and regeneration of bonechar, granular carbon, ion exchangers and reconditioning of filtercloths, etc. It is pointed out that in spite of a tendency to automation, it should be realised that all cleaning operations are manual operations where the personal decisions of the operating staffs have a tremendous effect on the economy and technical efficiency.

* * *

Progress Report on Decolorizing Sugar Liquors by the Use of Granular Carbon. A. J. ISACKS. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—The Southdown refinery for years used powdered vegetable carbons for decolorizing sugar liquors. The carbon was used twice in a counter-current two-filtration system, the twice-used carbon being made into a slurry, filtered, sweetened-off and discarded. A pilot filter using granular carbon was installed and operated over a month, after which it was decided to install eight filters 9 ft. diameter by 20 ft side, and to use granular carbon for full scale decolorizing in the refinery. At the same time a rotary kiln was installed for revivifying the used carbon. Progress made in the use of this carbon is reported.

* * *

Automatic Control of Affination Syrup. F. W. SCHWER. *Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—Considerations involved in planning automatic control of affination syrup are measurement of raw sugar weight, a pro-

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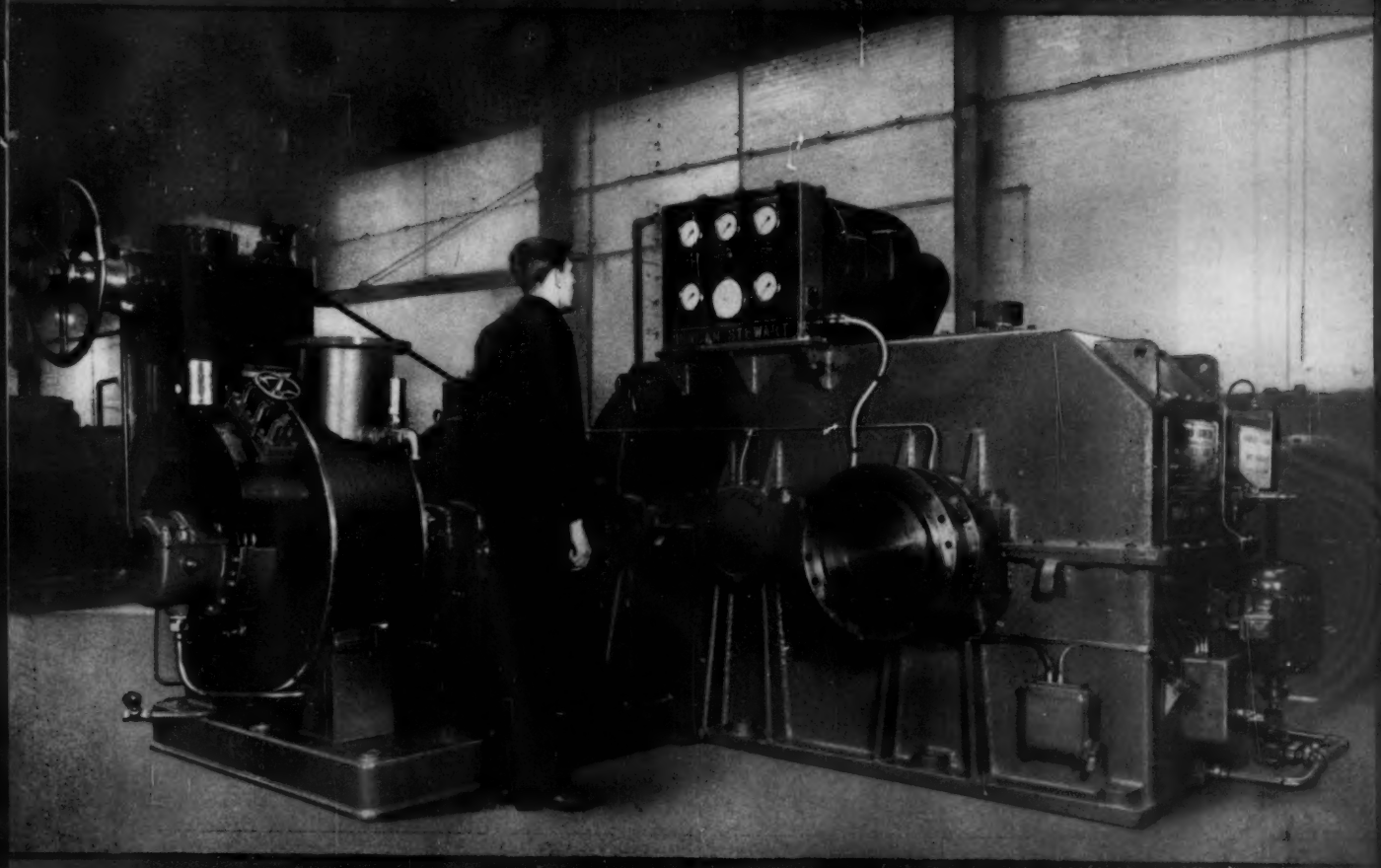

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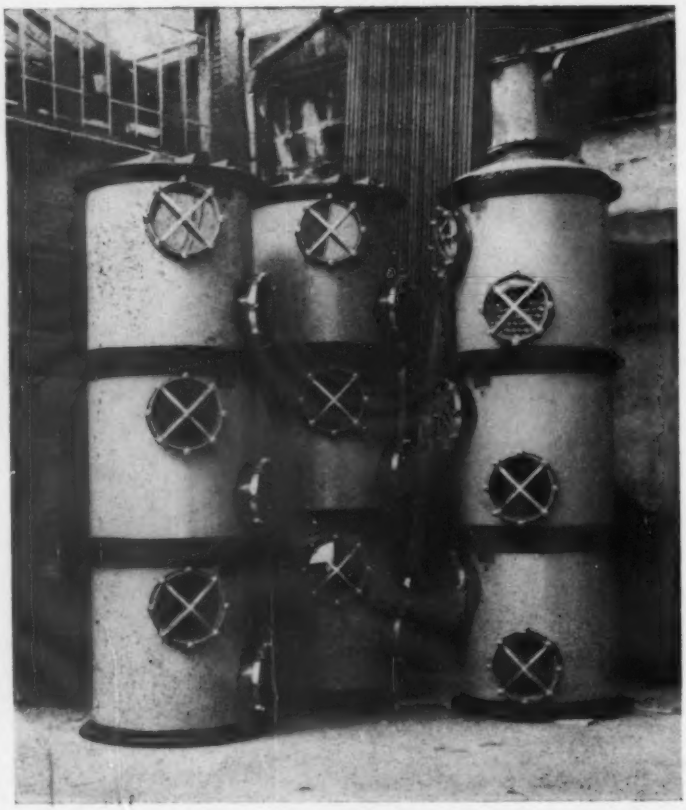

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portioning device for syrup, and provision for adjustment due to changes in physical properties of the raw sugar. A successful system is described which uses power needed to operate a bucket elevator conveying raw sugar to the minglers as a measure of weight. Proportioning is accomplished with a conventional pneumatic controller. Manual adjustments are needed as there is no feed-back. Possibilities for full automatic control through a cascade system based on measurement of magma fluidity are discussed.

* * *

Symposium on Automatic Control. E. D. GILLETTE *et al. Paper presented to the 18th Ann. Meeting, Sugar Industry Technicians Inc.*, 1959.—This symposium is devoted to automatic density measurement of sugar solutions and the use of this information in automatic control of evaporators and melters. Different types of measurement and control equipment are discussed, among them being bubbler, displacement and radiation types. Among the points considered are the sensitivity and dependability of the various systems as well as the sampling problems which may be encountered.

* * *

Infections caused by Leuconostoc mesenteroides. G. LAMOGLIA Y FRAU. *Bol. Ofic. A.T.A.C.*, 1958, **17,** 851–856.—Owing to drought conditions in Venezuela, and delays between harvesting and milling, the apparent purities of primary and mixed juices were 74·9 and 72·22, respectively. In addition these were higher than the true purities because of the dextran present as a result of heavy *Leuconostoc* infection. A truer estimate of purity could be made by clarification of samples with Horne's dry lead, but adding methanol. This precipitates the gum but does not appreciably affect the pol of the solubles; consequently the pol value of a parallel sample to which methanol was not added indicated the extent of infection. Refined sugar quality was high, however, in spite of the infection and low juice purity; this is attributed to the use of "Filter-Cel" and "Norit".

* * *

Soft Sugar System being Improved. ANON. *Cubelet Press*, 1959, **24,** (4), 4–5.—Modernization of the C. & H. soft sugar system at Crockett, California, to be completed in May 1959 included a new vacuum pan; new mixers and 5 new electrically-driven automatic Western States centrifugals. The pan, which is of stainless steel, is to be fitted with instruments and automatic controls. It will be of 1100 cu. ft. capacity, with a 12 ft. calandria and a 14 ft belt above this. The large mixer is in the form of a stainless steel horizontal cylinder, 30 ft long and of 7 ft dia., with revolving arms. This supplies three small mixers which feed the centrifugals.

* * *

Clarification under South African Conditions. P. N. BOYES. *Rev. Agric. Sucr.* (Mauritius), 1958, **37,** 265–270.—The clarification system used at Tongaat factory in Natal is described. A guiding principle is to avoid destruction of the floc once formed; consequently juice is heated before liming, and it is settled under gravity. The milk-of-lime dosage equipment is illustrated and described. Other practices to aid filtration and improve juice quality are: liming of clarifier muds before filtration and cooling to below the m.p. of the waxes, increasing the supply of bagacillo in the muds, and installation of cloudy filtrate settlers.

* * *

Ideas on Sugar Refining. R. NOËL. *Rev. Agric. Sucr.* (Mauritius), 1958, **37,** 271–276.—The refining of raw sugar is described with special reference to carbonatation and bone char treatment; phosphate defecation followed by bone char or vegetable carbon; and the Sucro-Blanc process.

* * *

Elements of Efficient Pan Boiling. R. BAX. *Rev. Agric. Sucr.* (Mauritius), 1958, **37,** 277–285.—The boiling of massecuites is reviewed from the aspects of equipment, instruments, boiling system, the magma system, graining, crystal size, conglomerates, false grain and fines, viscosity, molasses exhaustion, undetermined losses, and the effect of cane quality and clarification.

* * *

Purification of B-Molasses by Rapid Centrifugation. J. HALAIS. *Rev. Agric. Sucr.* (Mauritius), 1958, **37,** 286–290.—*B*-molasses is diluted to 74°Bx and heated to 75°C before passing through a Westfalia high-speed continuous separator. The Brix is reduced by separation of solids, while the purity is raised by 1–2 units, e.g. from 41·9 to 44·2. Recovery of aconitic acid from the solids is discussed; however the content in juice is so low that it is unlikely that recovery would be economic under Mauritian conditions.

* * *

Mill Bearings. J. M. PATURAU. *Rev. Agric. Sucr.* (Mauritius), 1958, **37,** 298–315.—After stressing the necessity for revision of empirical methods of mill bearings calculation in the light of recent developments, the author gives data showing that a mill bearing works generally under boundary lubrication conditions. A brief history of lubrication is covered and typical mill bearing compositions are given. Mention is made of roller bearings for cane mills. Different methods for cane mill lubrication are compared, causes of abnormal heating in bearings are reviewed and two methods of controlling temperature are discussed.

* * *

The Work of the Shredder. J. RAFFRAY. *Rev. Agric. Sucr.* (Mauritius), 1958, **37,** 316–320.—The National Morgan, Maxwell, Searby and Gruendler shredders are described, the last in detail and with illustrations. A Gruendler unit at Mon Loisir has resulted in an increase of reduced mill extraction from 95·86 to 96·07%. Another advantage is that tramp iron passing through the shredder creates considerable noise, acting as a warning of its presence. The hammers have dealt with 207,000 tons of cane and are expected to last another 200,000 tons before their tips need remetalling.

Control of the Purification Station for Pulp Press Water in Sugar Factories from the Aspect of Regenerated Water Quality. V. BARTL. *Listy Cukr.*, 1958, **74**, 271–275.—A study was made of the composition of recirculated water and the efficiency of purification plant at 3 Czechoslovakian sugar factories. Full details are tabulated.

* * *

Continuous Crystallization of Sugar Juices. J. MORZE. *Zucker*, 1959, **12**, 4–7.—A continuous crystallizer is described which comprises 14 narrow vertical sections in each of which is a 1–m high ribbed plate element fed with hot air from a pipe below. Thick juice is concentrated to 77–79°Brix with an extra vessel between the evaporator and the crystallizer, and is pumped at 75°C into the first section of the crystallizer. It is concentrated in the first 4 sections to 93°Bx, spontaneous nucleation taking place. Steam is introduced into the 5th and 6th sections, so reducing the supersaturation to prevent further nucleation, and the massecuite passes through the remaining sections to emerge as a continuous flow. The colour of the sugar is high as a result of using 125°C steam to heat the syrup; it is proposed to use 3rd effect vapour at 105°C instead. The massecuite is very fluid and is easily spun, although the sugar remaining in the basket is less. The capacity of the unit is 2·5 tons of massecuite per hour, retention time being 223 minutes and producing crystals of 0·4 mg.

* * *

Operation of the Llanquihue Sugar Factory (South Chile). W. WERNER. *Zucker*, 1959, **12**, 29–37.—The 1600–ton B.M.A. factory at Llanquihue is described and illustrated. Beet is unloaded wet and carried by a beet wheel to the 7–8000 ton silo. It is delivered to another beet wheel which lifts it to a channel feeding the washers, from which it passes to the knives and two BMA towers of 2·75 m dia. and 13·1 m effective height. Predefecation of the juice is followed by dry main liming. First carbonatation is under pH control, and the settled muds are filtered by two rotary filters. Clear juice and filtrate are passed through bag filters before second carbonatation and sulphitation. The evaporator downtakes are eccentrically located instead of central. Diffusers, carbonatation station, evaporators and pans are all on the same floor. Two calandria pans are provided for each of the three products, those for A-massecuites being of 225 sq.m. h.s. and for B- and C-massecuites being of 150 sq.m. h.s. Massecuites are pumped with "Rota" pumps, mingled C-sugar being sent to the B-centrifugal trough. For A-massecuite there are five deep-cone centrifugals of 500 kg capacity, for B-massecuite four 350-kg machines and for C-massecuites six machines also of 350 kg capacity. Affined B and C-sugar is remelted in thin juice. A Permutit water softening plant is used although the sea water used has a hardness of only 1·2°. The factory started operations on 29th May 1958.

* * *

Criteria for Low–Grade Work. V. SÁZAVSKY. *Listy Cukr.*, 1958, **74**, 275–277.—Conductimetric ash determination permits calculation of the following criteria : OP (organic non-sugars/ash) and PK (molasses pol/molasses ash). The molasses purity QM can be expressed in terms of these as QM = (100PK)/(1 + OP + PK). The criteria can be used as a guide to low-grade work since, from results over 10 campaigns in 14 factories, it has been found that OP is usually 2 ± 0·3, decreasing as PK decreases. In molasses exhausted in the laboratory for 150 hr at 35°C the purity was 1·5–3·0 units lower than that of the molasses when exhausted in the factory for 40–50 hr. From the OP value for filtered thick juice it is possible to forecast the value of QM by means of curves drawn of the relationship between these two at four different values of PK. For factory control the ratio of ash : 100 parts of sugar is an important criterion ; this may be 2·23 in the laboratory and 2·2–2·4 in the factory with good working.

* * *

Drying Pulp with Boiler Gases. A. K. NAIDENOV. *Sakhar. Prom.*, 1958, (12), 12–15.—Direct-fired pulp dryers are compared with flue-gas dryers. The nominal coal requirements of the former with a gas temperature of 120–130°C are 55–65% by weight of pulp i.e. 3·3–3·9% on beet. This figure does not include the energy required to rotate the dryer drum. A flue-gas dryer with a 2·4 m dia., 12 m long and using a gas temperature of 220°C will give 18–20 tons dried pulp per day while a 3 m drum, 15 m long, will produce 25–27 tons, using a temperature of 250°C. Tower dryers, with bottom-feed for hot gases, use too much fuel and have low productivity (10–15 tons dried pulp/day). Direct-fired "pneumatic" dryers use more fuel than drum dryers and the pulp is unevenly dried. It is calculated that a factory with plant for recovery of sugar from molasses, would use 11·5% coal on beet when drying with boiler flue gases at 250°C and 14·5% coal when using a direct-fired dryer.

* * *

Some Components Affecting Steffen Losses. J. R. JOHNSON and T. C. CHURCH. *J. Amer. Soc. Sugar Beet Tech.*, 1958, **10**, 34–41.—The effect of a number of factors was examined in regard to Steffen losses. Results show the importance of maintaining cooler temperatures below 18°C. Higher lime additions tend to reduce losses but not sufficiently to overcome increased losses due to high cooler temperatures.

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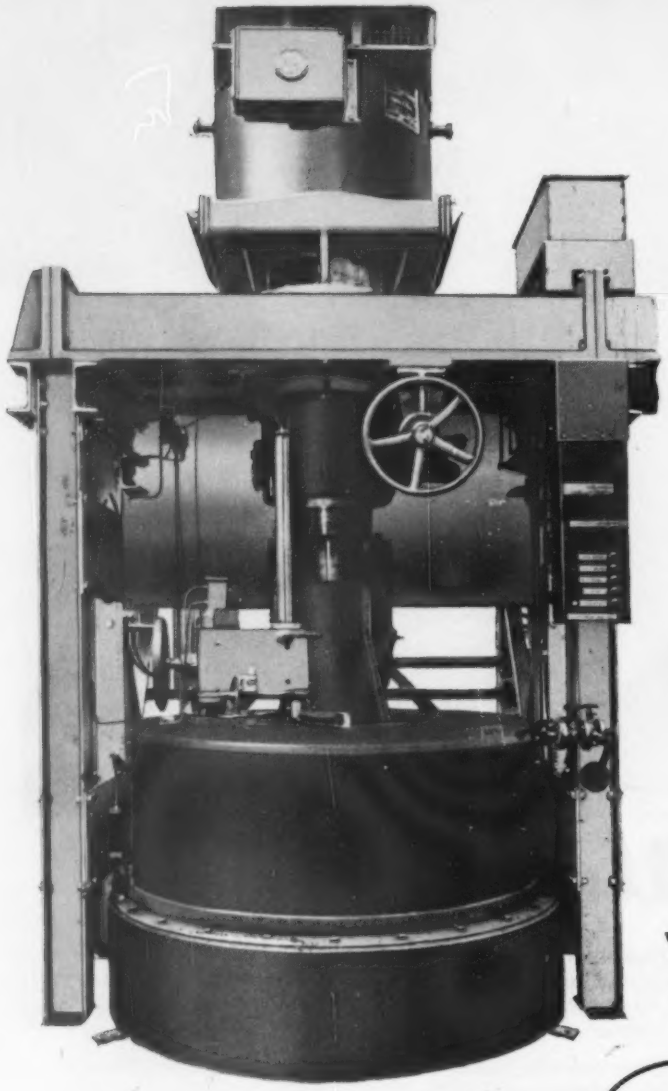

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* * *

Economical Efficiency of Juice Purification with Ion Exchangers. A. I. LITVINENKO. *Sakhar. Prom.*, 1958, (12), 40–42.—The running costs of an ion exchange plant for juice purification and the initial outlay are considered in relation to the possible cut in sugar loss in molasses. New Soviet anion and cation exchange resins are compared with older resins and their use compared with the normal saccharate process; ion exchange appears to be no more economical.

* * *

Process Experience of the use of Hydrocyclones in Sugar Factories. M. CZIRFUSZ. *Cukoripar*, 1958, **11**, 290–296, through *S.I.A.*, 1958, **20**, Abs. 881.—The conditions of sedimentation in still or flowing media and the theory of the separating action of hydrocyclones on suspensions is discussed in detail. The use of hydrocyclones for removal of sand particles from milk of lime, for preliminary separation of muds (particles $>3\mu$) from 2nd carbonatation juice, and for treatment of fluming and diffusion waters is described with illustrations, and some results are tabulated.

* * *

Experiences with the Two-Product Scheme. B. VICZIÁN and O. TISZAVÁRI. *Cukoripar*, 1958, **11**, 226–228; through *S.I.A.*, 1958, **20**, Abs. 895.—A four-boiling scheme at Mezohegyes, making two grades of refined sugar, has been replaced by a two-boiling scheme, to obviate middle-product boiling, making only granulated sugar. First product fine syrup washings are diluted in the 2nd melter to 60°Bx and mixed in a 3rd melter with the 2nd boiling low-grade sugar, and the syrup filtered through active carbon and added to thick juice (or as feed to the pans). The total massecuite has been reduced by 6½% on beet, steam used is reduced by 0·75 kg/q of beet and molasses has been reduced from 4·48 to 4·36% on beet (or from 2·28 to 2·23% on sugar). The sugar colour and quality has been improved.

* * *

Effect of Coagulated Colloids of Beet Juice on the Filtration and Sedimentation Properties of Mud Particles. Z. KOHNOVÁ and V. TIBENSKY. *Listy Cukr.*, 1959, **75**, 6–10.—The effect of pH and time of contact between precipitate and juice on the peptization of colloids during progressive predefecation was studied. Pressed juice and factory diffusion juice were used for the experiments, and the colloids were determined by alcohol precipitation. The predefecated juice was divided into two fractions which were heated and filtered, one after 5 minutes and the other after 60 min. Minimum peptization occurred at pH 9·2–10·8 (0·02–0·08% CaO), while at higher or lower alkalinities nitrogenous compounds were peptized more than non-nitrogenous. At pH 8·2–9·2 peptization was greater after 60 minutes than 5 minutes. At second carbonatation alkalinity (0·013–0·026% CaO) the muds volume increased linearly with the colloid content of diffusion juice although the alkalinity had no effect. Filtrability depended mainly on the alkalinity of the saturated juice and was little affected by the colloids content, a change in alkalinity from 0·13 to 0·26% CaO roughly halving the filtration rate.

* * *

The Complex Compounds at First Carbonatation. U. TOMIC. *Listy Cukr.*, 1959, **75**, 12–14.—Model raw sugar solutions, limed and saturated at 80°C, and filtered and saturated press juice were used to study the alkalinity and calcium content of filtered first carbonatation juice. When small amounts of EDTA were added to this, dissociated Ca ions were chelated, and the unchelated lime decreased accordingly. With larger amounts of EDTA, the drop in unchelated lime was greater than the equivalent of the EDTA and $CaCO_3$ was precipitated. With 0·5 equivalents of EDTA no unchelated lime remained in solution, while if more was added, some of the $CaCO_3$ was redissolved. It is concluded that the Ca is in the form of calcium sucro-carbonate which, when EDTA is added, liberates sucrose and carbonate ions which decompose further calcium sucro-carbonate to give $CaCO_3$ and sucrose. The calcium sucro-carbonate can also be decomposed by passage of a 10-volt 0·4–0·6 amp current through the juice.

* * *

New Equipment for Milk of Lime Purification. R. HARTL. *Listy Cukr.*, 1959, **75**, 13–16.—The equipment patented by J. BÍLEK and used in all Czechoslovakian factories for removal of sand and other impurities from milk of lime is described and illustrated by a diagram. A V-bottomed trough is divided into cells by baffles rising from the bottom and further baffles suspended into the cells so that milk of lime is forced to travel alternately over and under the baffles. A screw conveyor in the bottom of the trough carries the mud counter-current to the direction of flow of the milk of lime, and discharges it to a bucket elevator placed diagonally at the end of the trough.

* * *

Sugar Production from Frozen Beet. S. F. DRONOV. *Sakhar. Prom.*, 1959, (1), 23–28.—Frozen beets at various temperatures were immersed in water baths at temperatures ranging from 20°C to 80°C in 10° intervals. The temperature changes in the centre of the root were followed by means of thermocouples. Increasing the temperature from 20° to 80°C reduced the time of thawing to 0°C from 65–70 min to 17–25 min, the major part of these times being that needed to heat the beet to about –4°C, the m.p. of the ice in the root tissues. Frozen roots were thawed and warmed to 20°, 30°, 40° and 50°C and cossettes from these extracted with water at 20°C; extraction ranged from 97 to 99% indicating that heating is not necessary for sugar plasmolysis. Cossettes from frozen beet were unsatisfactory and pulpy; it is therefore recommended that longer fluming or washing (or hotter flume or wash water) should be used.

The Fives-Lille Filtration Plant. V. A. ZAMBROVSKII. *Sakhar. Prom.*, 1959, (1), 30–36.—The filter plant at Ryzhavsk factory comprises a 100 sq.m. Fives-Lille thickener[1] and two 32·7 sq.m. Eimco rotary cacuum filters, and started operation with the 1958/59 campaign. Juice is gassed to 0·07% CaO, 150% of juice being returned to predefecation. Juice is heated to 90°C and sent to the thickener which gives 75% clear juice and 25% thickened muds. Losses are 0·8–1·0% by weight of mud using 100% wash water on mud weight. The rate of filtration in the thickener is 7 litres/sq.m./min with a pressure of 1·2 atm, while the vacuum filters handle 16 litres/sq.m./min at a vacuum of 50 cm Hg in the filtration zone and 32 cm in the wash zone. The thickener cloths should be changed every 15 days and those in the filter every month, washing them with 5% and 1% HCl respectively.

* * *

Electric Drive Control Scheme of the PN–1200 Centrifugal. N. F. SHEVCHUK. *Sakhar. Prom.*, 1959, (1), 37–39.—Modifications to the electrical control equipment of the PN–1200 centrifugal are described and a wiring diagram given.

* * *

Furnace for Annealing and Hardening Beet Knives. D. N. ZAPOROZHETS. *Sakhar. Prom.*, 1959, (1), 54.—At Tsybulevsk factory a liquid fuel furnace has been found better than a blacksmith's forge for tempering beet knives and is described and illustrated.

* * *

Modernizing Gas Blowers and Centrifugal Pumps at Sugar Factories. D. A. TSUKERMAN. *Sakhar. Prom.*, 1959, (1), 54.—Improvements made to a centrifugal gas blower of Soviet design are described and the possibility of increasing the efficiency of centrifugal pumps is discussed.

* * *

Water Pollution by Sugar Factory Waste Water. D. KRAMER. *Zucker*, 1959, **12**, 53–57.—The literature on water pollution by beet factory wastes is discussed with 29 references. Organic matter content, etc., are tabulated for East German factories. For factories without waste water return the extent of pollution is about 180 bacterial population equivalent per litre per ton of processed beet, of which 55% derives from press and diffusion water, 41% from wash and flume water and 4% from condenser water. Complete return systems can reduce the waste water discharged from 15 cu.m. to about 0·5 cu.m./ton beet, although the pollution is reduced only to about 40 bacterial population equivalent. The need for adequate purification is indicated by the numbers of dead fish found in polluted rivers.

* * *

Battery Diffuser Automation. E. WALERIANCZYK. *Gaz. Cukr.*, 1959, **61**, 3–6.—Automatic control, recording and indication of various factors in battery operation are discussed.

Improvements to the Elmo Gas Pump Range. W. BAUME. *Zucker*, 1959, **12**, 57–60.—Latest items in the Elmo range of gas pumps are described and illustrated, including twin-rotor compressors, a special gas jet for use with vacuum pumps, and a combined vacuum pump-centrifugal pump for handling gas-water mixtures.

* * *

Fundamental Problems of Automatic Continuous Diffusion. J. DOBRZYCKI. *Gaz. Cukr.*, 1959, **61**, 6–8.—Automatic control of battery operation is discussed with respect to optimal diffusion.

* * *

Automatic Carbonatation Control. S. ZAGRODZKI and H. ZAORSKA. *Gaz. Cukr.*, 1959, **61**, 8–11.—Automatic control of first and second carbonatation is discussed with 33 references to the literature[2].

* * *

Automation of the Lime Station. J. DOBRZYCKI. *Gaz. Cukr.*, 1959, **61**, 11–13.—Questions of automatic control of lime and CO_2 production are discussed. It is pointed out that the most difficult factor to control is the limestone and coke feed. Difficulty is also found in controlling the milk-of-lime density.

* * *

Automatic Control of the Evaporator and Vapour Distribution. Z. KOKELI. *Gaz. Cukr.*, 1959, **61**, 13–15. Automatic control of steam, vapour and feed distribution in a quadruple effect evaporator is discussed.

* * *

Assessment of the Compressibility of Exhausted Beet Slices, Comparing the Laboratory Technique of AB. Landsverk with that of this Laboratory. R. CAROLAN. *Rpt. Irish Sugar Co. Ltd. Research Laboratory*, 1959, (40), 8 pp.—Results with the "Sana" laboratory press made for AB. Landsverk by Transmag S.A. of Zürich were compared with results using the CSE laboratory press. There was little difference and it is concluded from a study of the effects of the differences in operation—higher temperatures, greater layer thickness, higher frequency of mixing and shorter pressing time—that these factors were self-cancelling. The Lansdverk press has no advantages over the CSE press except portability—it uses a pressure gauge instead of a system of weighted levers—and although results with Irish pulp were worse than those quoted for Swedish pulp, this cannot be attributed to diffusion conditions or weather. The importance of adequate pressing time is indicated by the fact that dry substance increases by more than 5% when the time is increased from 5 to 25 minutes.

* * *

Sugar Production by Extraction (of Beet Cossettes) at Low Temperature. P. W. VAN DER POEL. *Proefschr. tech. Hogesch. Delft*, 1958, 72 pp.—See *I.S.J.*, 1959, **61**, 55.

[1] See *I.S.J.*, 1957, **59**, 221.
[2] See also *I.S.J.*, 1958, **60**, 301; 1959, **61**, 118.

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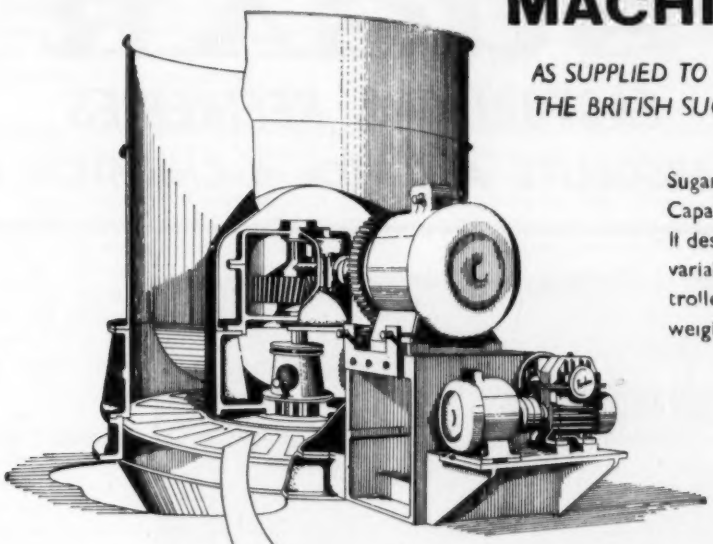

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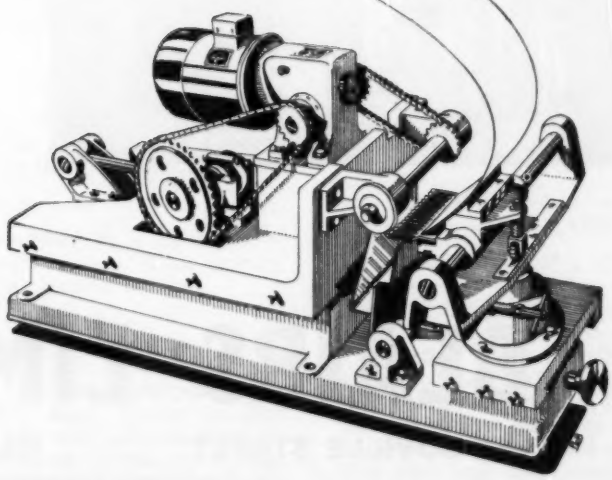

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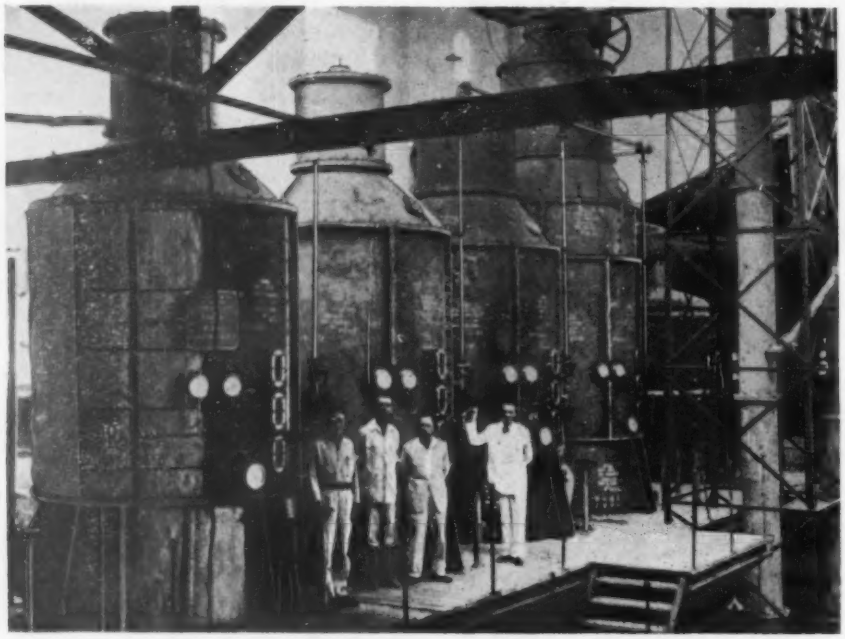

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Economics of Sugar Factory Machinery. III. The Economic Limits to Electricity Production in Sugar Factories. O. BOHN and L. SCHMIDT. *Listy Cukr.*, 1959, **75**, 25–33.—The various factors to be considered in the production of electricity within the factory instead of using the public supply are discussed. From the economics viewpoint the most effective capital investment is in a high capacity power station with a condenser installation; thus for a small factory, individual production is uneconomical.

* * *

Dependence of Sugar Content and Conductimetric Ash on Beet Size. J. HROMÁDKO and L. SCHMIDT. *Listy Cukr.*, 1959, **75**, 33–37.—Healthy beets freshly lifted and from piles were studied and average data given for the weight ranges. Sugar content did not fluctuate appreciably. While the white sugar rendement varied with sugar content, it tended to decrease with beet heavier than 1000 g. In all cases the conductimetric ash varied directly with root weight, increasing by about 0·12% per 100 g. The MW factor (molasses yield % white sugar yield) also increased with increased weight.

* * *

Decolorizing Ion Exchangers. V. The Effect of Certain Factors on the Static Evaluation of Ion Exchangers. V. VALTER and K. CIZ. *Listy Cukr.*, 1959, **75**, 37–42. The conditions most suitable for the static evaluation of ion exchange resins are those laid down by STAMBERG and FILIP[1]. For more significant comparison, it is better to determine the relationship between decolorization and weight of exchanger. A diluted molasses solution is preferable to a concentrated sugar solution for the tests, as the decolorizing effect is more representative of normal factory working, and decreases with increasing sugar concentration. A contact time of 3 hours at 80°C is sufficient for reproducible results. The validity of KROEKER's formula relating the amount of colouring matter adsorbed to weight of resin depends on the experimental conditions and type of resin, and it is only accurate for small amounts of resin. The relationship between the amount of colouring matter adsorbed and the concentration of colouring matter in solution at equilibrium is expressed by the Freundlich isotherm:

$$\log \frac{B}{G_p} = n \log B_1 + q$$

where B is the amount adsorbed, G_p is the weight of resin, n and q are constants and B_1 is the amount of colouring matter in the treated solution.

* * *

Continuous Extraction by Drum Diffusion. H. J. FISCHER. *Zuckererzeugung*, 1957, **2**, 89–92; through *S.I.A.*, 1959, **21**, Abs. 13.—Operational results are reported from Rossleben sugar factory in East Germany with a Bergé-type drum diffuser made by Maschinenfabrik Sangerhausen. With an average draught of 108% on beet, the sugar losses were 0·25% on beet. Graphs are given of temperature and pH, and juice Brix and pol values along the diffuser and other details are discussed. Trouble-free operation was achieved.

Choice of Diffusion Temperatures by Measuring the Heat Sensitivity of the Beet. K. VUKOV. *Zeitsch. Zuckerind.*, 1959, **84**, 82–87.—See *I.S.J.*, 1959, **61**, 246.

* * *

Forced Ventilation of Sugar Beet Piles. S. VAJNA, K. BAGERT and H. HEIDT. *Zeitsch. Zuckerind.*, 1959, **84**, 87–99.—Beet pile ventilation is surveyed with 30 references to the literature, and equations are developed for calculation of the amount of air needed to cool the beet and maintain uniform coolness. Factors involved are the respiration of the stored beet, distribution of air within the pile, and the intervals between the ventilations during which respiration increases the pile temperature. Sample calculations are made and graphs drawn. From the amount of air required to cool the beet (1440 cu.m./ton beet or 935 cu.m./cu.m. pile volume to cool to air temperature) and the ventilation intensity the necessary ventilation interval can be calculated. The calculations are based on a pile height of 7 metres.

* * *

Low Temperature Beet Diffusion. III. E. F. BOON, H. I. WATERMAN, P. W. VAN DER POEL, J. D. VAN ALPHEN and G. VAN WEERT. *Sugar y Azúcar*, 1959, **54**, (2), 23–25.—The juices produced by the cold diffusion process[2] have much less impurities in them and so are easier to purify. The juices were prelimed at 60° or 90°C and filtered before carbonatation. Results showed that it is best to add a small amount of SO_2 to the cossettes before treating with chloroform. The prelimed and filtered cold diffusion juice can be completely purified by passing through ion exchangers ("Imac C12" and "Imac A17"). The resultant juice gives a white sugar of 99·5 pol, 0·2% invert and 0·31% ash, and no syrup or molasses. Regeneration of the resin is as specified by the manufacturers and capacity does not appear to be decreased after many cycles.

* * *

Ion Exchangers in the Sugar Factory. J. DUBOURG. *Ind. Alim. Agric.*, 1959, **76**, 11–20.—A review of ion exchangers and their use in softening of juices, deionization of juices, substitution of Ca for Na and K in clear juice, and recovery of by-products including betaine, pyrrolidone carboxylic acid and glutamic acid.

* * *

Electronic Control of a Continuous Diffuser Plant. ANON. *Chem. Processing*, 1959, **5**, (3), 36–37.—The Evershed & Vignoles control equipment in operation at Wissington sugar factory of the British Sugar Corporation Ltd. is described and illustrated schematically. The thick juice tank level is measured and controls the flow of thin juice to the evaporators. A flow transmitter measures the thin juice flow which is automatically recorded and a level control in the thin juice tank also controls the flow of raw juice, which is also recorded. The raw juice flow is also reduced if the level falls in the pre-scalder tank. The

[1] *I.S.J.*, 1958, **60**, 274.
[2] See *I.S.J.*, 1959, **61**, 55.

diffuser drum speed is electronically controlled and related to the liquid level in the circulation tank. A mechanical transmitter is used in connexion with a Richard Simon & Sons Ltd. continuous belt weigher for regulation of the rate of cossette feed, this being determined from the speed of the drum. A Rotameter Mfg. Co. Ltd. transmitting flowmeter is used to measure diffusion supply flow, and an associated controller and electronic computer, receiving a signal from the belt weigher transmitter, automatically adjusts the diffusion supply flow in relation to cossette feed. Other controls include those for temperature, mixer level, diffusion supply tank level, mass flow (thick juice flow × density) and sludge flow.

* * *

Relationship between White Pan pH and Saponin Content of the Sugar. R. S. GADDIE and R. R. WEST. *J. Amer. Soc. Sugar Beet Tech.*, 1958, **10**, 171–176.—Investigation of saponin content of sugars and massecuites indicated that some of the low-saponin sugars came from high-saponin massecuites and some high-saponin sugars came from average-saponin massecuites. Study showed that the high-saponin sugars were associated with low pH in the massecuite and *vice versa*. Adjustment of pH of massecuites in the laboratory produced the expected results as far as sugar saponin was concerned. These facts were applied in the case of factories producing high-saponin sugar. In some cases, altering the end-point of second carbonatation was sufficient to keep pan pH above 8·5 and low-saponin sugar resulted. In one factory, however, the presence of nitrogenous compounds led to ammonia loss and organic acid formation in the evaporators with severe drops in pH; in this case 25% NaOH was added to the pan feed line and the pH was continually watched—by maintaining pH >8·5 it too produced low-saponin sugar.

* * *

High Capacity Shaft Lime Kiln. H. EIGEN. *Zucker*, 1959, **12**, 92–99.—The daily lime production per sq.m. of shaft area is proportional to the height of the combustion zone and inversely proportional to the time of burning of the limestone. Thus, the higher the zone and the shorter the combustion time, the higher the capacity. Equations are developed to express this relationship and for calculation of the capacity. A gas-fired shaft kiln at Ashtabula Works in Ohio, U.S.A. is described; it produces 336–435 tons of lime per day and at the lower rate the residual CO_2 content is 1·6% and the heat consumption 1140 kcal/kg lime of about 93% free CaO. The size of the stone is 51–83 mm and the combustion time 3·75 hours in a zone 5 m high, although the theoretical time for 83 mm stone is given as 2·2 hours. Kilns fired by methane or natural gas, as well as producer gas, are mentioned and the size of limestone in relation to increasing the capacity of the coke-fired kiln is discussed. A coke-fired kiln with gas supplement has been tested in the U.S.A. and has a 12 m high combustion zone, which, at 8 hr combustion time, would produce 33 tons of lime/sq.m./24 hr.

Continuous Juice Purification in the Beet Sugar Factory. G. VERNOIS. *Sucr. Franç.*, 1959, **100**, 71–76. A scheme is described for automatic juice treatment from diffusion to evaporation. It involves preliming, heating, main liming, first carbonatation, decanting, filtration of the muds on a rotary filter and return of clear filtrate with decanted juice to second carbonatation, filtration through presses, sulphitation and refiltration. Suitable equipment for the gassing, decantation and filtration is discussed in detail.

* * *

Reducing Sugar Losses in Diffusion. V. N. SHCHEGOLEV. *Sakhar. Prom.*, 1959, (2), 19–26.—To reduce sugar losses in pulp in a single-scroll rotary diffuser it is necessary to maintain uniform feeding of cossettes (automatically if possible) and of diffusion water as well as regular rotation of the drum. A 4·8 m dia. drum should rotate at 18–20 and no more than 24 r.p.h., while the cossette-juice mixture should not exceed the capacity of the 1st or 6th cells (in a 28-cell diffuser), the cossette : juice ratio being constant for each cell, but differing from cell to cell. Cossette length should be 12–15 m/100 g and the mean diffusion temperature 70–72°C (73–75°C at the head and at least 68°C at the tail). The water should have a maximum pH of 6. To prevent corrosion of the metal, 0·01% on beet of formalin should be added every 2 hr to cells 19–21. At Lannovsk factory the losses were reduced from 0·58 to 0·29% on beet and the throughput increased by 20%. Draught was 113%, mean temperature 70°C and cossette length 13 m/100 g.

* * *

Pilot Plant Trial of Diffusion Juice Purification with a Colloidal Calcium Carbonate Suspension using Separators. S. S. KUTSEV, V. A. KUZIN, O. P. NOVIKOV and B. N. BORISOGLEBSKII. *Sakhar. Prom.*, 1959, (2), 31–34.—A description is given of tests in which a mixture of milk-of-lime and diffusion juice (7% CaO) was saturated and added to diffusion juice at predefecation, after which the juice was treated in a centrifugal separator to remove the muds. The juice at 0·1% CaO was then heated to 90–100°C and saturated to the same alkalinity as 2nd carbonatation juice in the usual manner. After a second pass through the separator, the juice was said to be "no worse and sometimes better than factory juices". As pointed out in an editorial note, the work should be considered as only preliminary and exploratory, as there has been no comparison made with existing schemes using the same amount of lime as in these tests, and the statement on the quality of the juice is not supported by actual figures.

* * *

Hydrocyclones and their introduction into the Sugar Industry. H. HANNIG. *Zeitsch. Zuckerind.*, 1959, **84**, 135–138.—The application of hydrocyclones in various industries is discussed with illustrations of various types of Dorr-Oliver equipment. The use of hydrocyclones to remove sand from milk of lime and raw juice is recommended.

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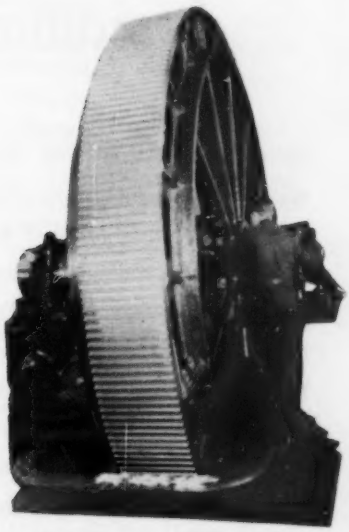

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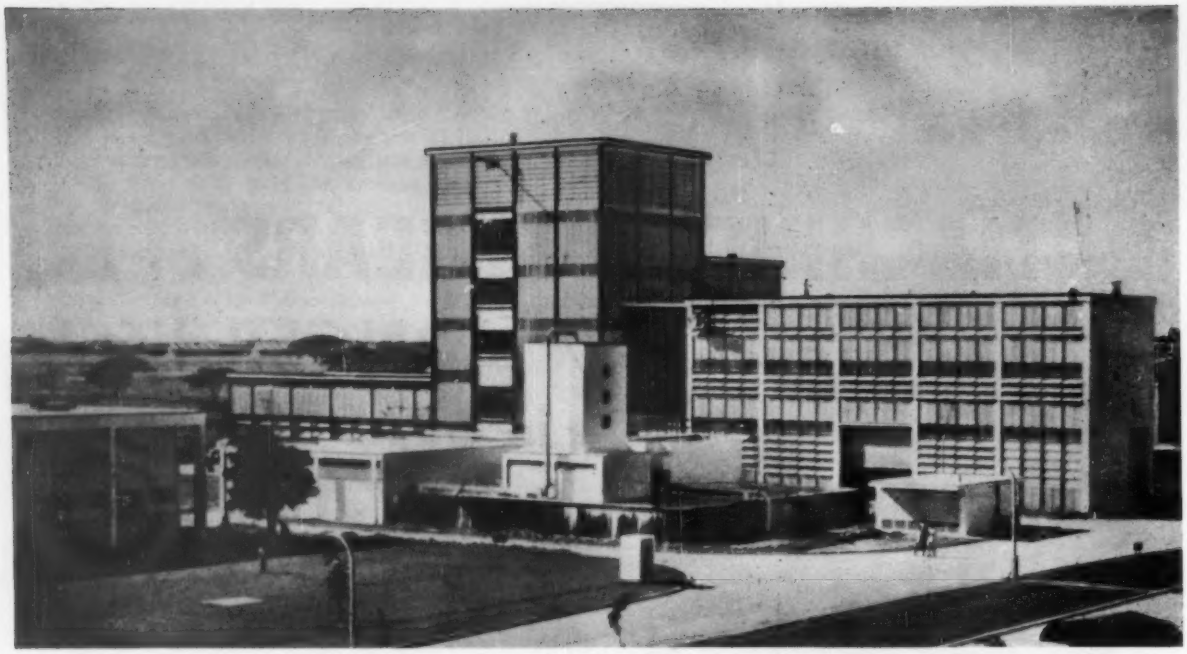

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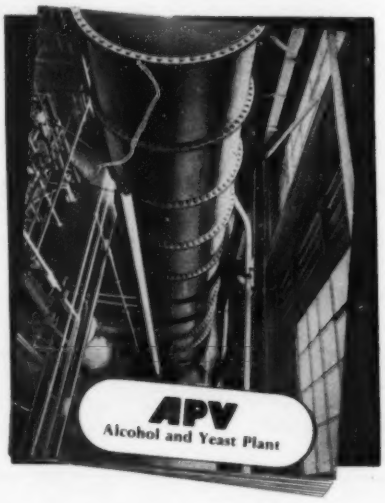

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Simultaneous Determination of Potassium and Sodium Content of Sugar Beet. K. MAGYAR and K. VUKOV. *Cukoripar*, 1958, **11**, 300–304 ; through *S.I.A.*, 1958, **20**, Abs. 942.—The solution to be analysed is passed through an ion exchanger which will replace Na and K ions by Ca ions. The calcium in solution before and after treatment is determined by titration with "Complexon" (EDTA). Tests with model solutions and beet juices are described and the results compared with those obtained by other methods, especially Wiklund's precipitation method. The ion exchange method and precipitation methods agreed well and both results showed little deviation from the theoretical values. For beet sampling the colloids in ordinary digestion juice will clog the ion exchanger and the juice must therefore first be clarified by liming, heating, filtering, removing excess Ca by oxalic acid treatment, and again filtering. The error of measurement by the new method is less than 2%.

* * *

An Hitherto Undiscovered Source of Error in Lime Determination by Means of the Calcimeter. C. VAVRINECZ. *Cukoripar*, 1958, **11**, 228–230 ; through *S.I.A.*, 1958, **20**, Abs. 944.—The apparatus is used for determining $CaCO_3$ in bone char, limestone, soils, scale, etc., by measuring the volume of CO_2 liberated by HCl. A correction is required for the volume change in trapped air when changes of temperature or pressure occur. A table of correction is given.

* * *

Modification of Lime Determination by "Complexon". G. VAVRINECZ. *Cukoripar*, 1958, **11**, 230; through *S.I.A.*, 1958, **20**, Abs. 945.—The method used by V. GRYLLUS can be modified to use one solution containing both the EDTA (6·8 g) and 34 g of NH_4Cl in 285 ml of conc NH_3 solution ; 1 ml is equivalent to 1 g of CaO. The "Eriochrome" indicator keeps better if 1 g is mixed with 200 g of sugar or KNO_3 and kept in a brown bottle ; 0·1 g is used, being added in two half-portions, one before titration and the remainder just before the end-point.

* * *

Useful Analysis of Bagasse. L. R. BLISS. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 225–234.—A method is described for a complete analysis of bagasse for use in examining milling performance of old or newly installed mills. Samples of bagasse are collected at 20-minute intervals in sealed containers and conserved with ammonia and chloroform. Composite hourly samples are made up and a proportion kept for preparing composite 8-hourly samples. The total pol in bagasse is determined by the method of BLISS, which involves disintegration of a 42-gram sample with 300 ml cold water and polarization of the liquid. Brix is read from tables after measuring the specific gravity of this liquid with a Mohr-Westphal balance which is accurate to 0·00005, corresponding to 0·025 °Bx. The sucrose in broken and intact cells is measured by the Khainovsky method[1] and the fibre determined on the 8-hour composite sample by disintegrating a 50-gram sample with 500 ml cold water for 8 minutes, repeating with second, third and fourth 500 ml quantites of cold water, collecting in a tared cloth bag, drying and weighing. Moisture is measured by drying a sample in a current of air at 130–140°C during 45 minutes, and degree of milling by an air-flotation method based on the same principles as that of Spolelstra[2]. The apparatus and method are described in detail. A method for determining the specific volume of fibre is being developed.

* * *

Visual Comparison of Granulated Sugar and Thick Juices Compared with Various Physical Measurements. M. ARVIDSSON and S. WRAMSTEDT. *Socker Handl.* II, 1958, **14**, 155–163.—Reproducibility and accuracy of visual grading of sugars (granulated or in solution) and of thick juices is compared with those of photometric reflectance measurements of the sugars and photometric colour determination of the thick juices. The grain size of the sugars may affect results as may the difference in shade of colour.

* * *

Chemical Synthesis of Sucrose. H. H. SZMANT. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 259–264.—The elucidation of the structure of sucrose and its synthesis are discussed, and an appeal made for industry and Government support for sucrochemical investigations to provide new uses for sugar.

* * *

Chemical Investigations on Carbohydrates at the Universidad del Oriente. H. H. SZMANT. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 265–269. Projects under investigation include new methods of esterification, acetal formation, and the study of reaction products from ethyl acetoacetate and monosaccharides.

* * *

"Reflectance Colour Value" of Sugars. H. OIKAWA and M. KATTO. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 15-25.—The colour of all sugar products may be expressed in terms of hue (dominant wavelength), brilliance and saturation. Since the first of these varies very little for sugars—between 570 and 579 mμ—a value based on the other two factors does not lead to great error. The

[1] *I.S.J.*, 1955, **57**, 440.
[2] *I.S.J.*, 1935, **37**, 188.

N.B.S. unit is approached by the value of (100–reflectancy at 450 mμ) and brilliance can be expressed as (100–reflectancy at 560 mμ) so that the authors propose a unit, the "reflectance colour value" defined as $100 - \frac{(100-\text{refl}_{450}) + (100-\text{refl}_{560})}{2}$, which simplifies to $\frac{1}{2}(\text{refl}_{450} + \text{refl}_{560})$. Sufficiently high correlation was found between the R.C.V. and visual grading of 45 samples of soft white superior, soft white medium and soft yellow sugars. The R.C.V. (x) and N.B.S. unit (y) are connected by the equation :

$$y = 0{\cdot}002195\ x^2 - 0{\cdot}7985\ x + 57{\cdot}71$$

which applies to a range of N.B.S. units which includes all sugar products. A nomogram is given for determining the N.B.S. value from the reflectances at 450 mμ and 560 mμ.

* * *

Determination of Whiteness of Soft White Superior (Sugar) by Sensory Test. S. ABE. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 1–14.—The ranking method and the Bradley and Wilcoxon paired comparison method of visual observation were compared using 26 observers and 39 samples of sugar. The results indicated accurate results by visual grading. Visual grading was also compared with the Judd "Index of whiteness"[1] and the Kamoda "Whiteness Value"[2], and showed good agreement.

* * *

Analysis of Main Metallic Cations in Sugars by Means of Ion Exchange Resins. J. OBARA and K. SUZUKI. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 26–31.—Samples of sugars and syrups, adjusted to 30°Bx, were added to the top of a column of "Amberlite IR–120" in the H-form, the amount of each sample being such that the total of cations was less than 4 meq for a column containing 11 cc of resin. The column was eluted with 0·1N, 0·5N and 3N HCl and the eluates fractionated. The relative proportions of the constituents were known from trials carried out previously with solutions of salt mixtures of known concentration. The Na and K were each determined by difference in 0·1N NaOH titre for the eluate and the same volume of 0·1N HCl; Mg and Ca by titration with 0·02N EDTA and Fe^{II}, Fe^{III} and Al colorimetrically. Results are tabulated for materials from Indonesia, Taiwan and Cuba, and it is considered that the method is more rapid, simple and accurate than analysis after incineration, when some loss occurs by volatilization.

* * *

Chromatographic Determination of Organic Acids in Raw Sugars and Sugar Liquors. J. OBARA and T. IWAKURA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 32–40.—The raw sugar or sugar liquor, adjusted to 15°Bx, was passed through an "Amberlite IR 120" resin column and the effluent neutralized with NaOH. It was then passed through an "Amberlite IRA 400" strongly basic anion exchanger and all acids adsorbed. They were eluted with N ammonium bicarbonate solution and the eluate evaporated to dryness, dissolved in a small amount of water, and treated with "Amberlite IR 120" to liberate the free acids. An excess of alcohol precipitated inorganic material and the organic acids were neutralized with NaOH and again evaporated. For paper chromatography the sample was again dissolved and the free acids liberated with "Amberlite IR 120" resin. The chromatogram was developed with (a) *n*-butanol : formic acid : water; (b) chloroform : *n*-butanol : formic acid, and (c) *iso*-amyl alcohol : formic acid. For silica gel column chromatography, the dried sodium salts were dissolved in 0·05N sulphuric acid and mixed with the silica gel and added to the top of the column from which they were eluted with mixtures of chloroform and butanol of various relative concentrations to release the different acids, the concentrations of which were found by alkali titration. The positions of the acids in the eluates had already been determined using known acids. The acids identified and their quantities are tabulated; they include oxalic, aconitic, gluconic, lactic, malic, levulinic, tartaric, fumaric, succinic, glycollic and citric acids.

* * *

Methods of Measuring the Reducing Intensity of Heated Sugar Liquor. M. IRITA and T. KIKUCHI. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 41–50.—Modifications are described to the Folin and Ariyama methods for determining reducing compounds to enable them to be used with sugar solutions. In the former, 5 cc of sugar liquor at 23–30°C is treated with 2 cc of phosphate buffer of pH 6·2 and 0·5 cc of Folin's reagent[3] (19·8 g pure sodium tungstate, 10·6 g of 89% orthophosphoric acid and 30 g water, heated together in a flask with a Liebig condenser until transparent; a few drops of bromide added to decolorise the solution, excess expelled by heating, and the solution cooled and made up to 100 cc). After standing for 30 minutes the absorbancy of the solution is measured at 720 mμ. In the latter method, 5 cc of sugar solution at room temperature is treated with 2 cc of Ariyama's reagent[4] (100 g pure sodium tungstate is dissolved in 600 cc water and treated with 50 g As_2O_5; 25 cc of 80% orthophosphoric acid and 20 cc of conc. HCl are added, the mixture heated for 20 minutes, cooled, treated with a few drops of bromine to decolorise the solution, excess expelled by heating and the solution cooled and made up to 1 litre), 1 cc of 1 M NaCN and 5 cc 1M Na_2CO_3. After standing at room temperature for an hour, the absorbancy is measured at 720 mμ.

* * *

Determination of Sugars in Molasses. Comparison of the Bertrand Method and Lane (& Eynon) Method and Determination of Unfermentable Reducing Sugars, varying the Conditions of Inversion. K. OKANO and T. KOSAKA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 51–64.—Equal values were

[1] "Colour in Business, Science and Industry" (Wiley, New York) 1952.
[2] *I.S.J.*, 1957, **59**, 24.
[3] *J. Biol. Chem.*, 1934, **106**, 311.
[4] *J. Biol. Chem.*, 1928, **77**, 359.

given by the two methods with molasses or sucrose solution after inversion, sugar and HCl concentrations having no effect. Lead clarification should not be used with either method, before or after inversion as this leads to low values and, in molasses which contained much non-sugar, to irregular results. With inverted molasses solutions the Lane & Eynon method gave lower results than the Bertrand method. When more HCl was used for inversion more unfermentable sugar seemed to be produced.

* * *

Quantitative Determination of Reducing Sugar with 2,3,5-Triphenyl Tetrazolium Chloride. K. AMAKO. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 65–69.—A solution of 25 g of refined sugar in 100 cc water is made and 4 cc placed in a test tube calibrated to 20 cc. To this is added 1 cc N NaOH and 1 cc 1% 2,3,5-triphenyl tetrazolium chloride while shaking. The solution is placed in a thermostatic bath at 80°C for 6 minutes, cooled quickly and 1 cc of 1·1 N acetic acid added. The resulting solution is diluted with four volumes of EtOH and the optical density measured at 490mμ. The result is then referred to a standard graph obtained using known concentrations of reducing sugar. The method measures from 0·1–1·5 mg reducing sugar, gives reproducible results, and shows good agreement with OFNER's method.

* * *

New Method of Moisture Determination in Soft Sugar for Quality Control. Y. KAMEI. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 70–73.—The Saranin carbide technique[1], modified by using water bath heating for 5 minutes at 80°C instead of infra-red heating at 115–135°C, was examined. Comparison showed that the carbide method gave results 10% lower than those by the usual drying technique; however, in spite of its lower accuracy, its rapidity makes it suitable as a routine control method.

* * *

Nature of the $CaCO_3$ Sediments obtained by Carbonatation. M. KOMOTO and E. HAMAGUCHI. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 91–98.—$CaCO_3$ precipitates obtained from CO_2 and solutions of CaO in water and sucrose solutions were examined. The sedimentation volume was larger with smaller lime dosage and higher reaction temperature; sediments obtained with the de Haan process were denser than those obtained by the old process and it is concluded that higher velocity of $CaCO_3$ crystallization produced a more bulky precipitate. The higher the reaction temperature and pH, the smaller was the average individual particle size. The numbers of particles was approximately $1{\cdot}2–1{\cdot}4 \times 10^{10}$ particles per gram. The degree of aggregation and mechanical strength of the aggregates was greater in the old process than with de Haan carbonatation, and the presence of Na_2CO_3 or NaCl also gave large particles and improved aggregation. The de Haan precipitate had a greater power for decolorization of affination syrup, and a lower filtrability than the old process. The Mergen reaction was exhibited by old process precipitates, in spite of the fact that they contained less than 10% of aragonite. De Haan sediments were typical calcite. The effects of aragonite and calcite on decolorization and filtration of the sugar solution were studied.

* * *

Melting Point of Sugar Products. M. KAMODA and T. YAMANE. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 115–122.—The melting point of pure recrystallized sucrose samples was found to lie between 173·4 and 174·8°C. With cane sugar the m.p. lay between 166 and 191°C and with beet sugar between 180 and 189°C. The addition of salts was found to raise the m.p. (except with $CaCl_2$ which lowered it), the effects being in the order Na acetate > K acetate > NaCl > KCl. Once melted, the sucrose would not always recrystallize, due to decomposition which occurred on heating.

* * *

Determination of Calcium and Magnesium in Cane Juice. M. C. BENNETT and N. O. SCHMIDT, *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 119–126.—See *I.S.J.*, 1958, **60**, 225.

* * *

Regression Analysis as applied to some Control Data in Raw Sugar Factories. R. F. INNES. *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 205–233.—Mill data obtained under a wide range of imbibition % cane within a single factory have shown that regression analysis could be of value as the basis for Control Charts, and five such analyses are suggested. An analysis of the behaviour of fibre % cane compared with Brix of first expressed juice suggests that the errors in the mill control data of some of the factories examined were appreciable. Five regressions were examined over eight factories showing a range of agreement between the variance of the Brix of 1st expressed juice and the variance of the fibre % cane. The analyses bear out the usefulness of regressions as a means of examining factory data and indicate that, whereas highly accurate regressions are possible even in factories drawing upon a most variable cane supply, some factories produced data in which not only was the statistical "error" excessive, but the parameters to the regressions were unreal. The relative values of different regressions are deduced and the best estimates of the parameters are given.

* * *

Rate of Crystallization of Sucrose at High Temperatures. P. V. GOLOVIN, A. A. GERASIMENKO and M. A. ABRAMOVA. *Sakhar. Prom.*, 1959, (1), 28–30.—The rates of crystallization of sucrose at 70, 80 and 90°C in pure sucrose solutions, factory syrup of 93·08 purity and in green molasses of 72·98 purity have been studied by measuring the weight of growing crystals supported on quartz threads. The rate of crystallization in the pure solution increased linearly with supersaturation, the rates being higher for the

[1] *I.S.J.*, 1958, **60**, 111.

higher temperatures. The relationships with the syrup were in the form of curves owing to an increase in viscosity with supersaturation. The rate of crystallization from the green molasses at constant supersaturation increased up to 80°C, thereafter decreasing[1]. The absolute viscosity of the three supersaturated solutions was determined with a modified capillary viscometer; at constant dry solids content a 10°C rise in temperature over the range 70–90°C almost halved the viscosity. With pure saturated solutions, the crystallization rate increases over the range 70–90°C in spite of a viscosity rise from 82 cp to 92 cp. Why the rate of crystallization decreases over the range 80–90°C cannot be explained fully although tentative suggestions are offered, including the inhibition of crystallization by surface-active substances.

* * *

Determination of Carbon Dioxide in Molasses. F. DURDÍK. *Listy Cukr.*, 1959, **75,** 10–11.—Comparison made between the manometric determination of CO_2 in a Warburg apparatus and the amount of foam formed on acidifying dilute molasses with 30% phosphoric acid showed a positive correlation which is illustrated in the form of a graph.

* * *

Effect of Ortho-Phosphoric Acid and Phosphate Ions on the Reaction Velocity of Sucrose Inversion. H. A. SCHÖNGART. *Zeitsch. Zuckerind.*, 1959, **84,** 10–16.—The inversion rate constant of sucrose in the presence of hydrochloric and ortho-phosphoric acids was determined polarimetrically at 60° ±0·02°C using a specially adapted polarimeter tube to meet the strict temperature requirements. The initial sucrose concentration was constant at 10 g per 100 ml water, a raffinade of 0·0024% conductimetric ash being used. In the pH range of 1·14 to 2·50 (measured at 18° ±0·002°C) the inversion rate constant was smaller with phosphoric acid than with hydrochloric acid, the difference ranging from 15·02% at pH 1·14 to 11·22% at pH 2·50. No relationship could be established between the rate constant and pH for either acid. The dissociation of phosphoric acid is discussed and the effect of the acid and its salts studied. The experiments show the inversion to be primarily and strongly catalysed by hydrogen ions, anions and non-dissociated acid molecules also having a noticeable catalytic effect. The maximum error in the inversion rate constant determination was 0·02%.

* * *

Selective Enzymatic Determination of Sugars in Sugar Factory Products. S. BÖTTGER and W. STEINMETZER. *Zeitsch. Zuckerind.*, 1959, **84,** 16–24.—A non-polarimetric method is described in which glucose oxidase added to a sample containing glucose converts it into gluconic acid and hydrogen peroxide; the latter is decomposed by catalase in the enzyme preparation and liberates oxygen which is measured manometrically in a Warburg apparatus. Results are compared with those using a chemical method involving Muller's solution; the values obtained are higher and lower than corresponding results, the greatest difference being 0·86% glucose compared with 1·54% by the chemical method when used with a concentrated vinasse. The difference is attributed to reducing non-sugars in the vinasse. When estimating polysaccharides, these are treated with a single or suitable combination of enzymes, e.g. for sucrose, the glucose oxidase is combined with invertase which first hydrolyses the sucrose, producing glucose on which the oxidase can act. If any invert is present with the sucrose this must be destroyed with glucose oxidase before adding the invertase. Raffinose is estimated by treatment with glucose oxidase, invertase and melibiase; it is first split into fructose and melibiose and the latter hydrolysed liberating glucose which is then acted upon by the oxidase. For adequate accuracy, at least 1 mg raffinose must be present, which means the preliminary destruction of 50–100 mg sucrose; this is accomplished by atmospheric oxidation over 7–8 hours—this can be reduced to 3 hours by passing oxygen through the solution. A disinfectant, e.g. cetyl trimethyl ammonium bromide, should be added to prevent bacterial sugar assimilation Results with the new method were checked by adding pure sucrose and raffinose to the samples; the error was ±1%, and this accuracy can be improved by modifying the Warburg apparatus.

* * *

Use of "Versene"—Possibility of increasing Exhaustibility of Molasses. III. Rôle of Lead Sub-Acetate used for Clarification in the rise in Purity obtainable by "Versene". S. N. G. RAO, N. A. RAMAIAH, S. K. D. AGARWAL and –. VISHNU. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 55–68.—See *I.S.J.*, 1959, **61,** 183.

* * *

Laboratory Experiments on the Comparative Efficacies of Antifoaming Agents to be Used in the Sugar Industry. N. A. RAMAIAH and S. K. D. AGARWAL. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 69–70.—A method for comparison is described. Molasses is inoculated with yeast and fermented, and 200 cc portions are placed in a series of vessels comprising a 35-cm long tube, 8 cm wide, fitted at the bottom with a sintered glass disc. Below the disc the diameter of the tube is reduced to 1·5 cm. Air at constant speed is blown through the sintered disc, causing intense froth formation so that the molasses rises to the top of the tube. At this point the antifoaming agent is added, suppressing the foam. The bubbling of air is continued until the foam builds up to its original height, and the time taken is noted. This time is an indication of the efficiency of the agent.

[1] See also *I.S.J.*, 1958, **60,** 368.

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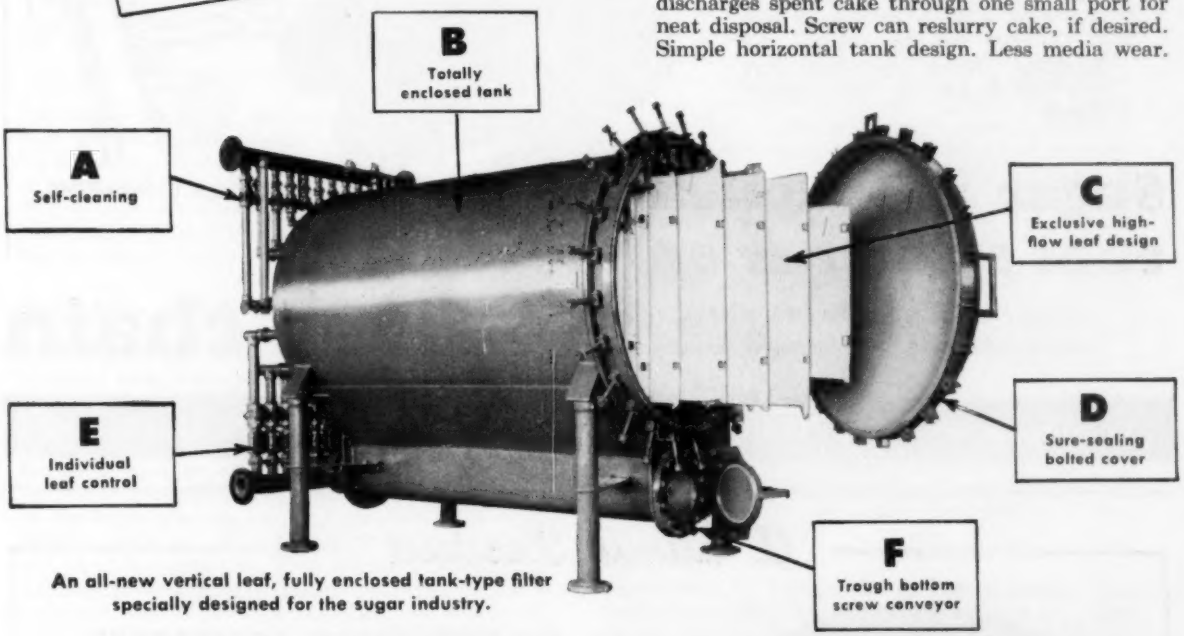

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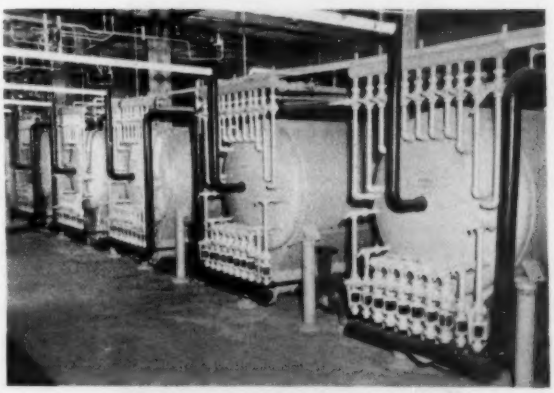

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Cuban Bagasse Products' New Bagasse Board Plant Now Operating. H. J. TOMLINSON. *Sugar J.* (La.), 1959, **22**, (8), 41–43.—The brief history of Cuban Bagasse Products S.A., its plant at Cruces, Las Villas, and the process employed, are described.

* * *

2,3-Butanediol Formation in Molasses Cultures. K. BAHDUR and S. RANGANAYAKI. *Indian J. Appl. Chem.*, 1958, **21**, 74–76; through *S.I.A.*, 1959, **21**, Abs. 27.—Different strains of five micro-organisms (13 types in all) were grown under similar conditions in molasses solution (10·2 g sucrose per 100 ml without additional nutrients) at 30°C for 75 days; the initial pH was adjusted to 6·5. By far the largest yields of 2,3-butanediol (on the basis of sugar consumed) were given by the Poona (Indian National Collection) strains of *B. subtilis* (15·13%) and *Serratia marcescens* (21·84%). *B. polymyxa* and *Aerobacter aerogenes* strains formed more reducing sugar than theoretically available from the sucrose present.

* * *

Pretreatment of Molasses for Ethanol Fermentation. IV. J. P. SHUKLA and B. D. KAPOOR. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 39–42.—Treatment of molasses with 3·4% on Brix of ammonium sulphate is equivalent to the Ca content and precipitates 42% of it. The calcium thrown out of solution on distillation is reduced to 1·5% w/v compared with 2·4% with untreated molasses, and the yeast has an ash content of 2·95% (8·4% untreated) and gives a higher rise in the total reducing matter : ash ratio than other pretreatments, as well as producing a greater volume of CO_2 on fermentation. Thus, the use of ammonium sulphate pretreatment in Indian distilleries will give a cleaner yeast of lower ash content, and will reduce scaling in the analyser column. In addition, the high N content will give higher fertilizer value to the wastes and will all be utilizable so that the transfer of $(NH_4)_2SO_4$ from fertilizer to molasses pretreatment will not, in effect, cost anything.

* * *

Utilization of Lime Sludge from Sugar Factories. Studies on the Possible Use of Calcined Carbonatation Press Mud for Liming the Juices. N. A. RAMAIAH, S. K. D. AGARWAL and R. SHYAM. *Proc. 26th Conv. Sugar Tech. Assoc. India*, 1958, 75–80.—Process difficulties arise if calcined press mud is used for liming—juice clarity is reduced, scale forming constituents increase markedly, and after a second operation the press mud when calcined is very poor in lime content (21·3% available CaO) and contains much ferric and aluminium oxides and silica. In addition, an expensive rotary kiln would have to be installed to calcine the muds.

* * *

Studies in Waxes. XIII. Refining Sugar Cane Wax by Fractionation from Solvents. H. H. HATT and A. H. REDCLIFFE. *Australian J. Appl. Sci.*, 1958, **9**, 380–403.—The literature on solvent purification of crude cane wax is reviewed, and a number of solvents compared for refining efficiency. Some of these resolve the crude material into fat, hard wax and pitch fraction. The fatty fraction must be removed first so that the hard wax can be obtained in only one more step. Hydrocarbon and halogenated hydrocarbons are unsuitable solvents. Performance of low boiling solvents may be improved by use under pressure. Solvents of high C:O ratio are often improved by dilution with water and those of low C:O ratio by mixing with a hydrocarbon. Among pure solvents 2-ethoxy ethanol approaches acetone and *iso*-propanol as a refining solvent, but for use under Australian conditions a 4:1 mixture of ethanol:heptane (or equivalent petroleum fraction) has strong claims. The mixture needs more complex recovery equipment than does a simple solvent, but its components are readily available, and its composition may be adjusted slightly to meet the demands of a particular crude wax.

* * *

Yeast Plant in Taiwan is Doing Well. ANON. *Taiwan Sugar*, 1959, **6**, (1), 19–20.—A brief account is given of the production of torula yeast at Hsinying for use in hog feed and perhaps human diets in the future.

* * *

Experience in Application of Bagasse Hardboard for Construction Purposes. Y. C. LOW. *Taiwan Sugar*, 1959, **6**, (1), 23.—Recommendations are made for conditioning, jointing, nailing and finishing of "Canetex" bagasse hardboard when used as a construction material.

* * *

Distribution of Compounds in Polysaccharide Syntheses using Dextransucrase. B. WEIBULL. *Acta Chem. Scand.*, 1958, **12**, 568–573; through *Socker Handl.* II, 1959, **15**, 1–4.—Quantitative results for the synthesis of methyl α-*iso* maltoside and its homologues from methyl α-D-glucoside and sucrose using dextransucrase were recently reported. The distribution of the saccharides can be accounted for if it is assumed that the synthesis proceeds by means of a stepwise transfer of glucosyl groups from sucrose to the primary hydroxyl group of the growing polymer. The rate of the first step is lower than that of the following ones, which seem to be kinetically identical. The reaction thus formally is analogous to the polyaddition of ethylene oxide to water and alcohols. The consequences of these results for the synthesis of dextran are discussed.

* * *

Studies on the Production of Itaconic Acid. M. BUENDÍA and J. M. GARRIDO. *Rev. Cienc. Apl.*, 1958, **12**, 481–495; through *S.I.A.*, 1959, **21**, Abs. 93.—Numerous experiments on the culture of *Aspergillus terreus* NRRL 1960 on a medium based on cane molasses are reported in detail. Good yields of itaconic acid have been obtained in the presence of high concentrations of monosodium phosphate (0·18 g NaH_2PO_4 per 100 ml of medium).

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Ion Exchange Water Purifiers. Elga Products Ltd., Railway Place, London S.W.19.

The "Elgastat Mark II" equipment is available in two versions as shown, the first for commercial-grade distilled water quality, where a capacity and exhaustion indicator is fitted, and the second, for critical applications, where a conductivity monitor forms an integral part of the unit and gives an accurate check throughout the exhaustion cycle. All exposed components are of corrosion-resistant plastic and the units will give

10 gallons per hour of "equilibrium" water (4 megohms/cm) or 20 gallons per hour of distilled quality water. A standard modification makes it possible to pipe de-ionized water to any number of draw-off points, and no regeneration *in situ* is necessary since there is a world-wide cartridge replacement service.

* * *

Screw-Feed Elevator. Russell Constructions Ltd., 9 Adam Street, London W.C.2.

A new precision-built elevator, developed by Russell Constructions Ltd., is fitted with a feed hopper from the base of which two opposed horizontal spirals lead material into an inclined elevating spiral which propels it to a height of 5½ feet (or 11 feet if an easily-fitted extension is added). The unit is powered by an electric motor through a torque converter and output speed can be controlled with accuracy in ranges of ½–3 tons/hr or 3–12 tons/hr depending on whether the motor is of ¾ or 1½ h.p. The machine is easily dismantled for cleaning and the bearings are specially sealed. It is quiet and raises no dust, and is mounted on trolley wheels so that it can be moved to different locations by the operator.

* * *

Continuous Weight Feeder. Richardson Scale Co. Ltd., Albert Street, Bulwell, Nottingham.

The standard model of a new continuous weight feeder is of up to 1000 cu.ft./hr capacity and can be supplied in open form or totally enclosed. It is suitable for use with materials ranging from fine powders to rock products and accuracy is of the order of $\pm\frac{1}{2}\%$ over a two-minute period, although it varies, of course, with the output and nature of the material being handled. The unit is fitted with a flanged belt and self-aligning oil packed ball races. For granular materials gravity feed from a hopper is used with a depth regulator, while with powders a variable speed screw feeder is supplied. Feed control is from the weigh conveyor pulley to avoid hunting at low belt speeds, and the machine can be used both for continuous feeding and also for batch weighings.

* * *

PUBLICATIONS RECEIVED

STELLAR FILTERS FOR THE SUGAR INDUSTRY. The Paterson Engineering Co. Ltd., 129 Kingsway, London W.C.2.

Booklet P 694 describes the "Stellar" filter and its use with many illustrations and clear text. The filter is well known in many industries but has comparatively recently been introduced for filtration of sugar juices and syrups. The fluted tubular element carries a wire wound around it in an accurately machined screw thread, and a kieselguhr precoat is built up on this. At the end of the filtration cycle, in which the elements, suspended in a pressure vessel, treat the cloudy material, the liquor is drained and the cake removed by a technique whereby pressure is built up on the filtrate side and then suddenly released on the cake side of the elements. Pictures show the filters handling carbonatation juice, thick juice, standard liquor, etc. These emphasize the cleanliness and labour-saving of the new technique compared with older-type filters.

* * *

Roll Sulphur for Indonesia. F. W. Berk & Co. Ltd., London, who melt many thousands of tons of sulphur a year, have just shipped a further consignment as part of an order for 775 tons of roll sulphur for Indonesia. Sulphur for the sugar industry must be carefully selected for purity and only one source has been found to give a raw material which will consistently give a product of a sufficiently high quality.

* * *

Craig Factory for Persia.[1]—A sugar factory is to be erected at a cost of about £2,500,000 at Kavar in Persia for the Sherkat Shami Chande Pars Company. The machinery will be supplied by A. F. Craig & Co. Ltd. and will be capable of processing 1000 tons of beet per day, with facilities for expansion to 1500 tons. The factory is due for completion in 1961, and the contract allows for the training of Persian personnel in operation and maintenance of the plant.

[1] *The Times*, 17th August, 1959.

Professor Ing. R.N. Dr. KAREL SANDERA

The Deputy Minister of Food, Czechoslovakian Republic, Ing. Dr. R. BRETSCHNEIDER, has sent the sad news of the death of KAREL SANDERA in Prague on July 8th at the age of 56.

His long illness had prevented him attending the 12th Session of ICUMSA in Washington last year, but nevertheless he had completed a long and useful report as Referee on the subject of Gravimetric and Conductimetric Ash which he submitted together with his contributions towards the discussions of other subjects, all of which were presented on his behalf.

This effort was typical of his great interest in the work of ICUMSA, at least since 1936 when he attended the 9th Session in London. He was elected a Vice-President at the 10th Session in 1949 and re-elected at the 11th and 12th Sessions in 1954 and 1958.

As a sugar technologist his published work had already brought him international recognition. During nearly a quarter of a century of work, he published the books listed below:

Raw sugar massecuites. Technology, control, heat economy and theory of boiling. K. SANDERA. Prague, 1935.

Polarization apparatus in analysis, for the factory, and in scientific laboratories. K. SANDERA. Prague, 1945.

Sugar factory calculations. J. PUCHERNA and K. SANDERA. Prague, 1951.

Food engineers handbook. General and sugar factory tables. M. DRACHOVSKÁ, J. HRUBÍSEK and K. SANDERA. Prague, 1952.

Towards higher yields of sugar by protection of the sugar beet. Instruction in the protection of sugar beet for year 1953. K. SANDERA and M. DRACHOVSKÁ (editors). Prague, 1953.

Fundamentals of sugar manufacture. Part I. Manufacture of sugar in the field. M. DRACHOVSKÁ-SIMANOVA, V. STEHLIK, K. SANDERA. Prague, 1955.

One of his earliest papers was "A new apparatus for the electrometric determination of ash in sugar-house products." (*Chimie et Industrie*, 1927, Special No. 651), while almost all the rest of his papers appeared in *Listy Cukrovarnicke* and its predecessors *Zeitsch. fur die Zuckerindustrie der Czech. Rep.* and *Zeitsch. für. die Zuckerind. Böhmen und Mahren.*

He was of outstanding scientific rank in his country—Doctor of Science, Professor of Physical and Carbohydrate Chemistry in the College of Science and Technology, Prague; Member of the Order of Labour; Member-correspondent of the Czechoslovakian Academy of Science; and Member of the Faculty of Inorganic and Food Technology. He was a member of many other scientific and technical societies, and as recently as last June he was honoured at the 50th Anniversary of the Italian Association of Sugar Technologists by his election to the rank of Honorary Associate. Quoting the words of his own countryman "Czechoslovakian Science, education and industry lose in him an outstanding expert and teacher, which loss will be felt for a long time." These comments can be extended to the sugar industry in other parts of the world where he had many friends who will pay tribute to his work and memory.

H. C. S. DE WHALLEY.

New Factory for Germany[1].—Zuckerfabrik Franken A.G. of Ochsenfurt have decided to construct a branch factory at Zeil am Main, to process 300 tons of beet per day. The total cost is estimated at DM 50 million.

* * *

Polish Sugar Factory for Iran[2].—The Polish Foreign Trade Organization, CEKOP, has received an order for the construction of a sugar factory in Iran to the value of $4½ millions.

* * *

U.S. Sugar Cane Crop, 1958[3].—Sugar cane harvested for making sugar amounted to 6,182,000 tons in 1958 compared with 6,334,000 in 1957. The U.S. average yield per acre at 24·4 tons was down only slightly from 1957. Louisiana yields were up 0·3 tons from 1957 but in Florida where the carryover from the late freeze of the 1957 crop was more pronounced, the yield was down from 41·7 to 37·9 tons per acre.

* * *

Refining in the Dominican Republic.—Porrvenir refinery of the Azucarera Haina Company at San Pedro de Macoris has started production of refined sugar under the brand name "Eversweet", and recently shipped 7000 tons to New York as part of a 120,000-tons order.

Polish Sugar Expansion Plans[4].—Poland plans to increase her present sugar production of 1,100,000 tons to 1,500,000 tons by 1965, and to achieve this is to modernize 33 sugar factories and to erect one new factory.

* * *

Jugoslavian Sugar Plans.[5]—Erection of the Pec sugar factory is to start soon, and by 1961 it is expected to produce 20,000 tons of sugar from 150,000 tons of beet. Factory capacity in the country will total 8500 tons/day by 1961 and this is to be expanded to 9500 tons by 1965. Per capita consumption was 5·2 kilos in 1939 but has increased to 8·1 kilos in 1952, 11·6 kilos in 1956 and 15·0 kilos in 1958. This is expected to rise to 18 kilos in 1961 and 23 kilos in 1962. Beet production in 1959 is estimated at 2,300,000 tons from 90,000 ha, and with improved cultivation methods it is hoped to harvest 3½ million tons from the same area by 1966.

[1] *Neue Zürcher Zeitung*, 9th June 1959.
[2] *Zuckererzeugung*, May 1959.
[3] *Willett & Gray*, 1959, **83**, 255.
[4] F. O. LICHT, *International Sugar Report*, 1959, **91**, (6), 56.
[5] *Zeitsch. Zuckerind.*, 1959, **84**, 359.

BREVITIES

Indonesian Sugar Export Plans[1].—According to an announcement of the Indonesian Ministry of Trade, Indonesia will have resumed sugar exports in August. Before World War II the country was one of the most important sugar exporters of the world. In view of the low production and difficulties in transport, exports were stopped last year. At present, Indonesia is able to produce about 850,000 tons of sugar a year, 700,000 tons of which are necessary to cover the domestic requirements. The Indonesian Ministry of Trade estimates sugar exports at about 150,000 tons, to go to Mainland China, Japan, Burma, Thailand, Ceylon, Singapore and Hong Kong. The prospects for the Indonesian sugar exports are thought favourable. Apart from the sugar factory erected by East German firms[2], further factories are to be erected in South Sumatra and East Java. Before World War II, 145 sugar factories were working in Indonesia; now there are only 52.

* * *

South Korean Sugar Export Plans[3].—The Cheil sugar refinery in Pusan, South Korea, plans to export at least $500,000 worth of refined sugar annually to South-East Asia. To facilitate this project the refinery has asked the Ministry of Commerce and Industry to waive commodity and customs taxes on sugar. South Korea does not grow either cane or sugar beets but does refine sugar imported from the Caribbean, South America and the Philippines.

Stock Exchange Quotations

London Stocks (*at 17th August*, 1959)	CLOSING MIDDLE
Anglo-Ceylon (5s)	16/9
Antigua Sugar Factory (£1)	16/–
Booker Bros. (10s)	24/3
British Sugar Corp. Ltd. (£1)	19/3
Caroni Ord. (2s)	4/1½
Caroni 6% Cum. Pref. (£1)	17/9
Distillers Co. Ltd. (6s. 8d. units)	27/7½
Gledhow Chaka's Kraal £1)	74/–
Hulett & Sons (£1)	85/–
Jamaica Sugar Estates Ltd. (5s units)	6/10½
Leach's Argentine (10s units)	14/–
Reynolds Bros. (£1)	62/6
St. Kitts (London) Ltd. (£1)	61/3
Ste. Madeleine (Ord.) (£1)	30/6
Sena Sugar Estates (10s)	26/9
Tate & Lyle (£1)	47/–
Tate & Lyle Investments Ltd. (5s)	14/6
Trinidad Sugar (5s stock units)	28/6
United Molasses (10s stock units)	38/–
West Indies Sugar Co. Ltd. (£1)	22/–

New York Stocks (*at 15th August* 1959)	CLOSING MIDDLE $
American Crystal ($10)	8⅛
Amer. Sugar Ref. Co. ($100)	30¼
Central Aguirre ($5)	22⅛
Cuban American ($10)	22¼
Great Western Sugar	26⅝
South P.R. Sugar	21⅜
United Fruit Co.	34⅛
West Indies Sugar Corp. ($1)	36¼

ICUMSA

Italian National Committee.

The following members were elected at a meeting of the Italian Association of Sugar Technologists:

Prof. LEO CAVALLARO (University of Ferrara);
Dott. GUIDO GISMONDI (Societá Eridania Z.N., Genoa);
Dott. GUIDO MALAGUZZI-VALERI (Societá Eridania Z.N., Genoa);
Prof. GIORGIO MANTOVANI (University of Ferrara);
Prof. EUGENIO MARIANI (University of Rome);
Ing. GOFFREDO PIERONI (Soc. Pontelongo, Padua);
Dott. RENATO SALANI (Soc. Italiana Industria Zuccheri, Bologna), and
Prof. IPPOLITO SORGATO (University of Padua).

This Committee has been duly affiliated to ICUMSA and registered by the Secretary.

Proceedings of the 12th Session.

The Chairman of the Publication Committee reports that all manuscript has been galley-proofed and most of it has been corrected. There is every hope that the volume should be available in October.

Vice-President K. Sandera.

The Czechoslovakian Deputy Minister of Food has sent from Prague the sad news of the death of Professor KAREL SANDERA on July 8th. Elected a Vice President of ICUMSA in 1949, he was re-elected again in 1954 and in 1958. An obituary notice appears on another page.

H. C. S. DE WHALLEY (*President*).

Brazil Crop Restriction[4].—Grinding of sugar cane is to be limited to a period of seven months during the 1959–60 campaign which began on 1st June, according to a Reuter report. In the south, the grinding period will run from 1st June to 31st December and in the north from 1st September to 31st March. Other measures under the sugar defence plan for the 1959/60 crop have yet to be agreed upon by the Executive Commission of the Sugar and Alcohol Institute. The 1959/60 crop is officially placed at 3,060,000 metric tons and cane left in the field to be carried over into the 1960/61 season is estimated at the equivalent of 540,000 tons sugar. For internal consumption 2,400,000 tons will be set aside, about 540,000 tons for export, about 61,000 tons reserve required by the International Sugar Agreement and about 30,000 tons for statistical readjustment of internal stocks.

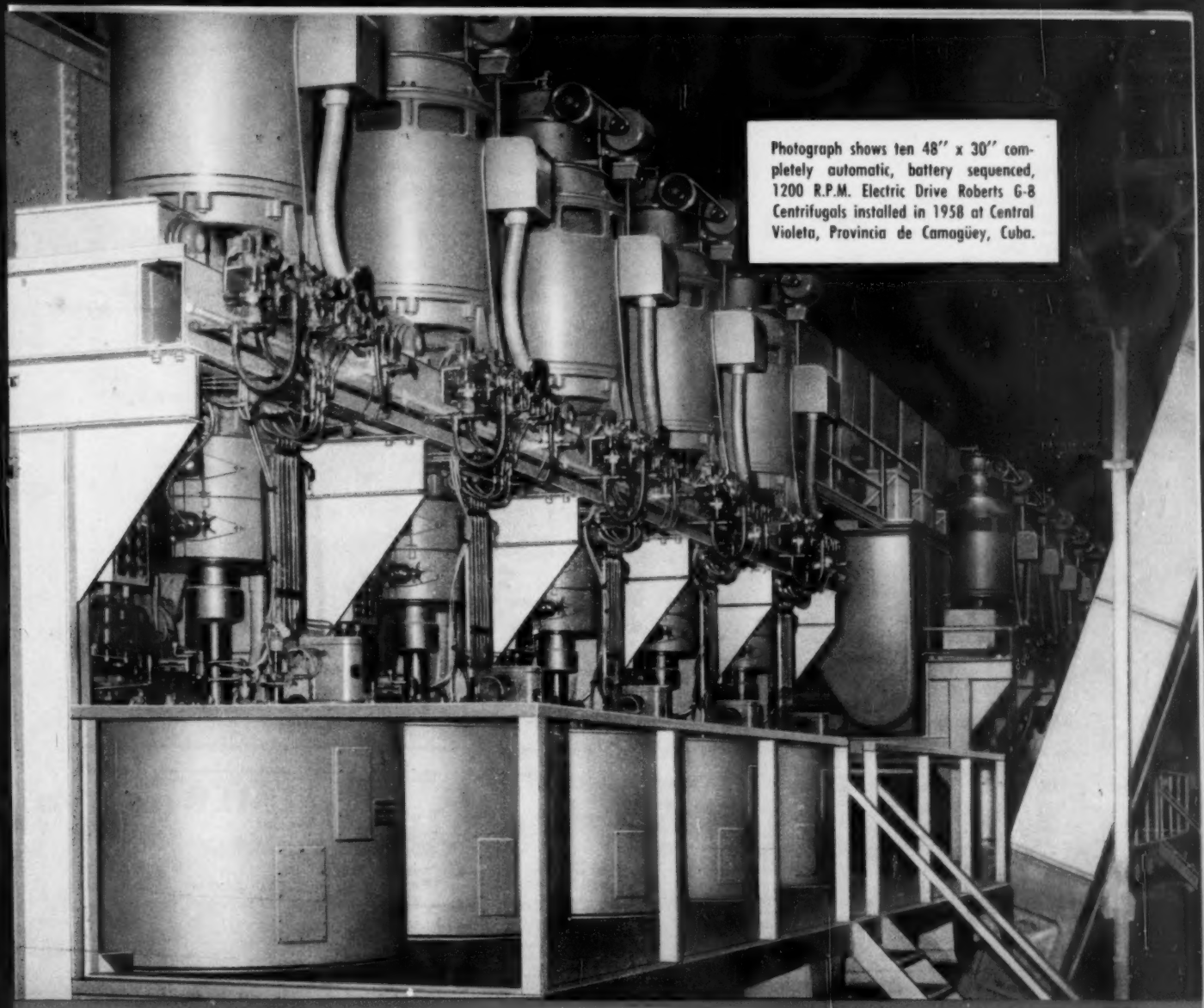
* * *

Chile Sugar Production, 1959[5].—Production in Chile this season from the three beet sugar factories now operating is expected to be in the region of 50,000 tons. Plans for a further factory to be installed at Paillaco in Vadivia are under consideration, according to the Bank of London and South America. It is intended eventually to have twelve factories in the country which, it is hoped, will make it self-supporting.

* * *

Afghanistan—U.S.S.R. Trade Agreement.[6]—A protocol was signed on 27th April for goods exchanged between the U.S.S.R. and Afghanistan in 1959 including supplies of sugar from the U.S.S.R.

[1] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Suppl. 13), 178.
[2] *I.S.J.*, 1958, **60**, 361.
[3] *Foreign Crops & Markets*, 1st June 1959.
[4] C. Czarnikow Ltd., *Sugar Review*, 1959, (408), 95–96.
[5] C. Czarnikow Ltd., *Sugar Review*, 1959, (414), 118.
[6] GATT *International Trade News Bull.*, 1959, 208.



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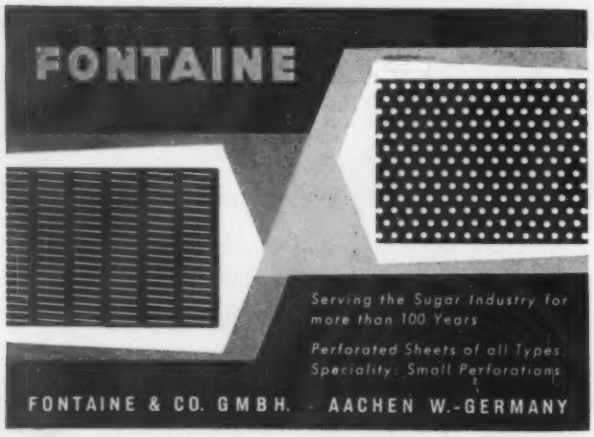
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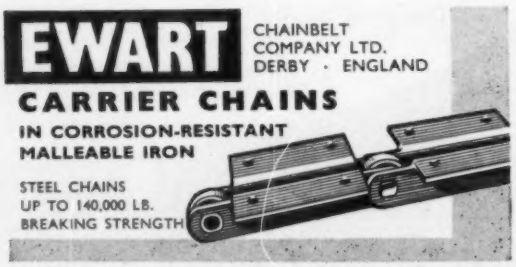

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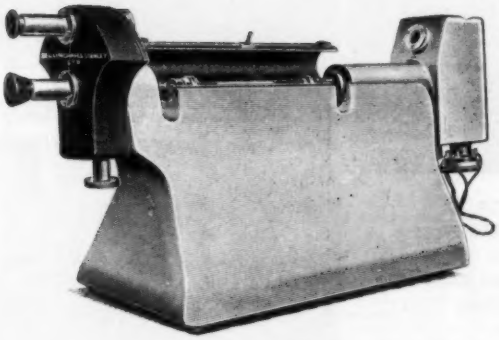

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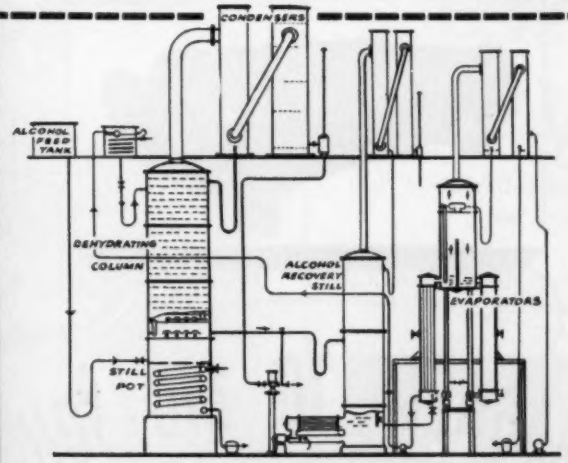

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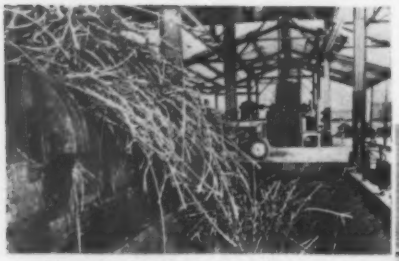

Cane Knives—Carriers—Feeder Tables

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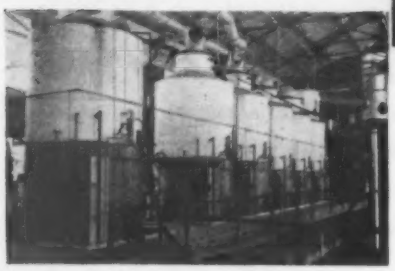

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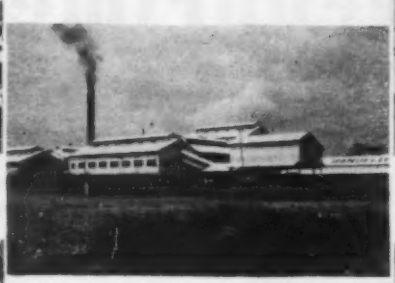

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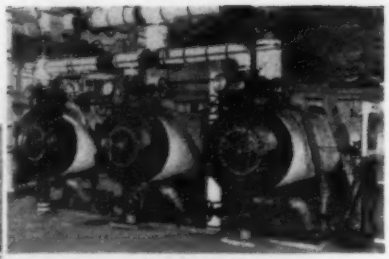

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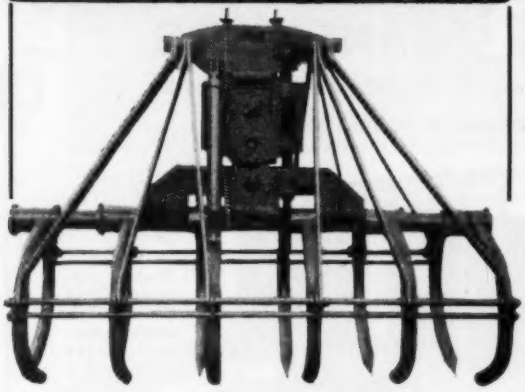

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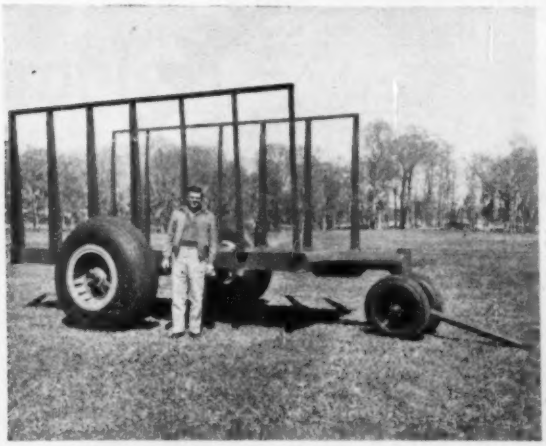

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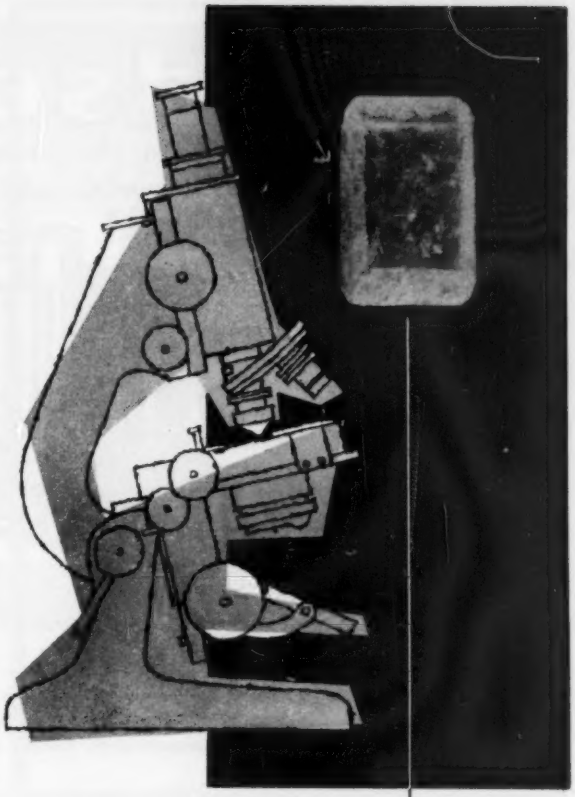

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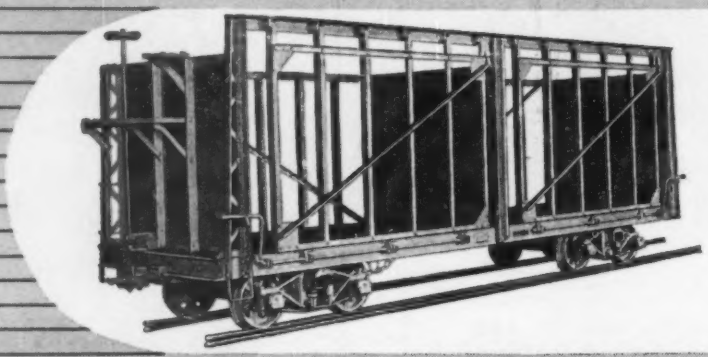

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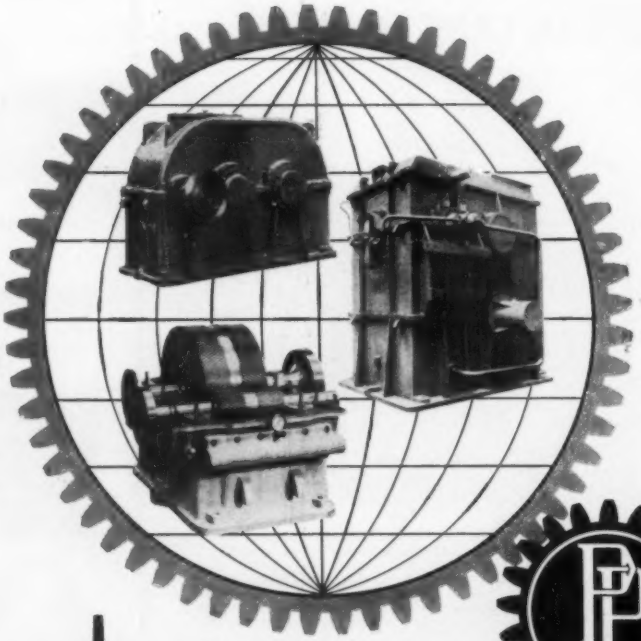

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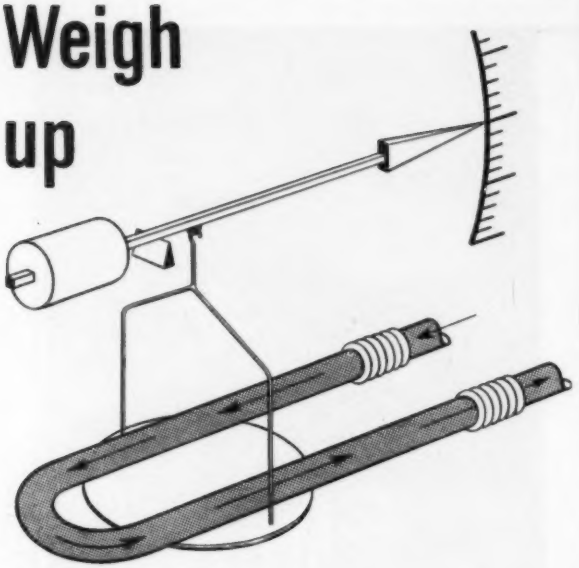

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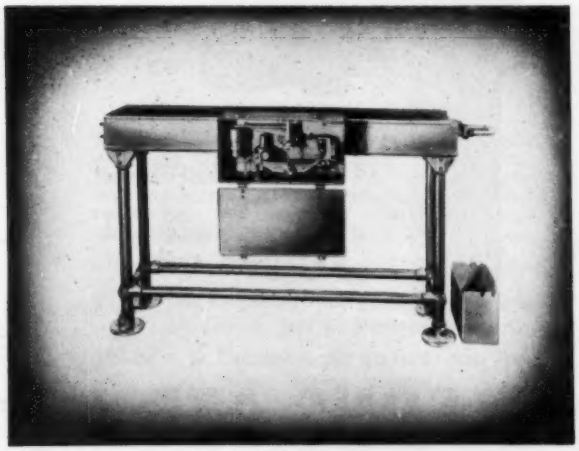

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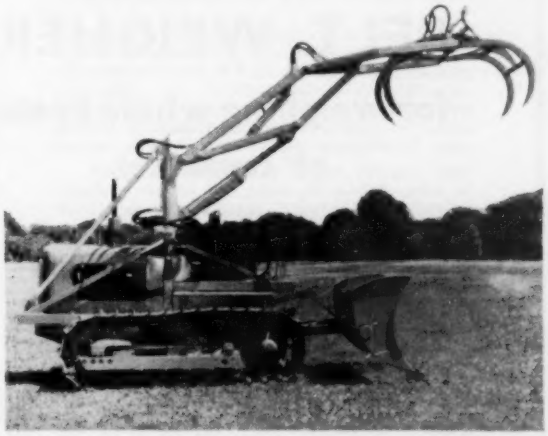

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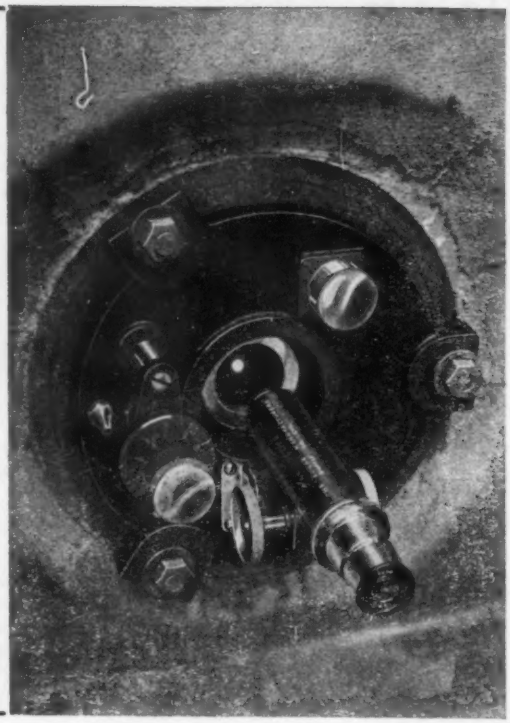

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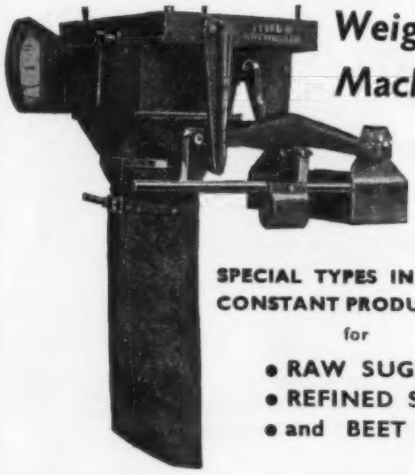

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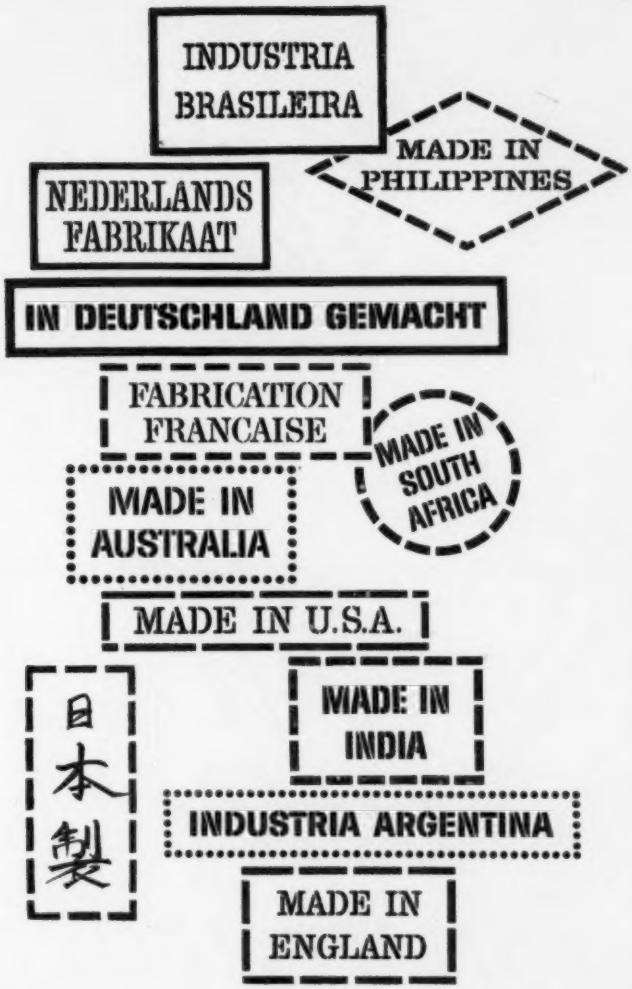

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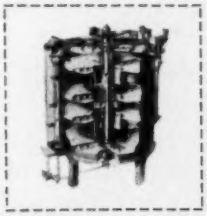

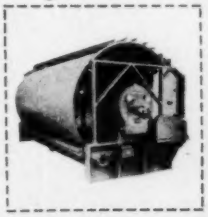

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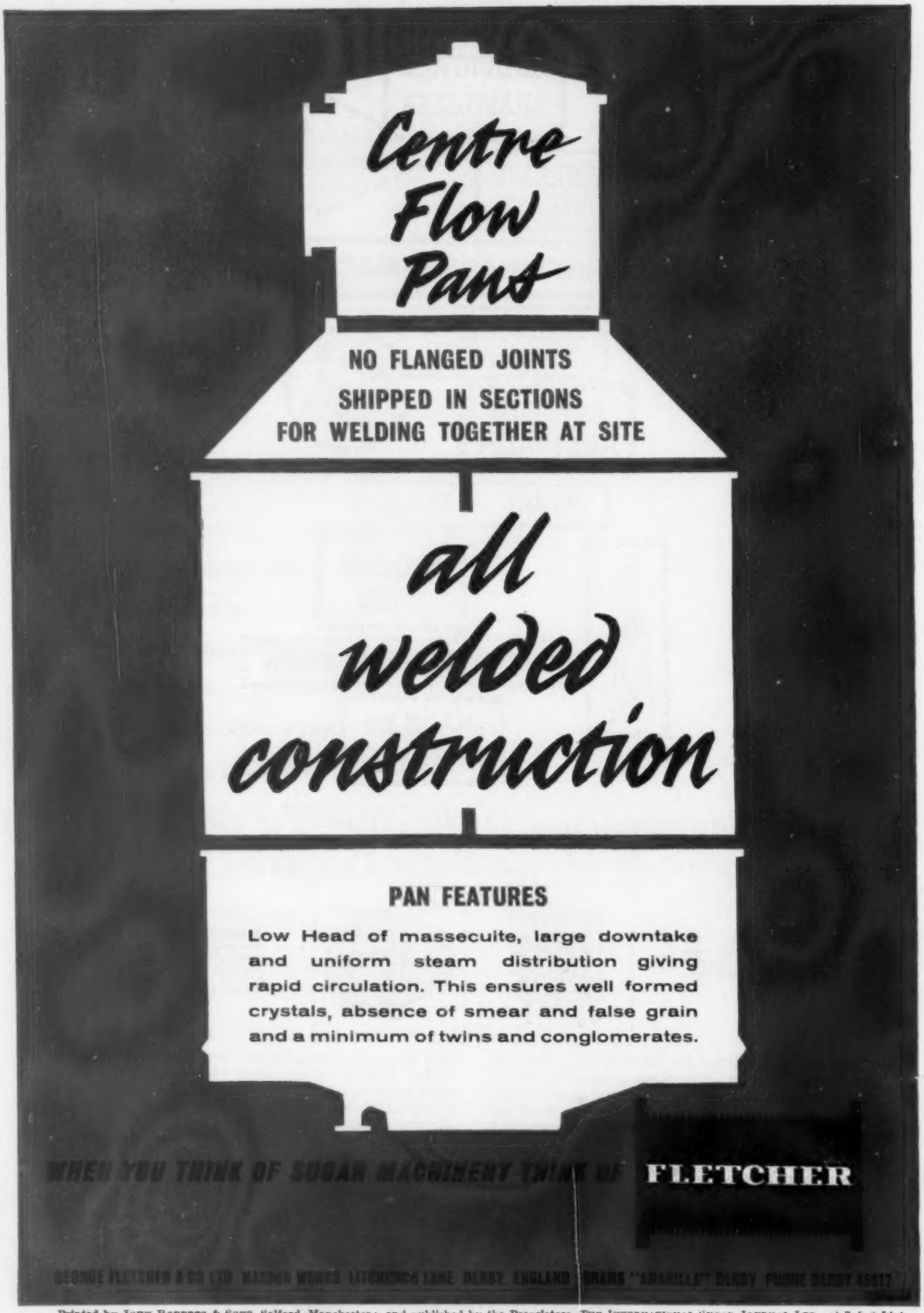
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